A Contractor's Experience in China.

Mr. John Dixon, whose name was brought forward prominently in connection with the removal of "Cleopatra's Needle" from Egypt, gives the following account of his experience in the construction of the experimental line between Shanghai and Woosung: The length was 9¼ miles, and the gauge was only two feet. This experimental railway was constructed by a syndicate of merchants and others interested in developing the future trade of China. The object was to show the Chinese a working line and to test the public feeling in the matter, and, not least, to ascertain decisively whether there was any insuperable difficulty to railway construction from the graves of ancestors scattered broadcast through the land, and the reverence for which it was always alleged would be beyond the power of money to overcome.

For reasons of economy and other matters the very narrow gauge was adopted, and Mr. Dixon, having been deeply interested in the adventure, was entrusted with the execution of the design. Land had been quietly bought with singular discretion from some 237 different proprietors—a few pounds had seldom failed to overcome the scruples as to the graves and they soon began to produce them in any quantity, one proprietor maintaining with good Chinese honesty that he had five mothers-in-law interred on a strip that was wanted! The native population were delighted with the work, and jealously claimed the right of each parish to provide the labor for the earthworks of its own section. The only trouble the contractors ever had was in consequence of this; they pleased them as to the rough labor, but could not in the skilled labor of plate-laying, etc.

The railway was very rapidly finished, and proved a brilliant success. During the fifteen months it remained open some three-quarters of a million passengers were carried, the trains constantly having to start long before the appointed time, being simply full, and the supply of rolling stock limited.

Difficulties not foreseen, were, however, in store. A treaty was being negotiated, and the Imperial Government raised objections to having any railways made in China that were not their property. If England covered China with railways, some day there might be a dispute, the upshot of which might be that we considered China our property; hence their determination. But they very fairly offered to purchase the Shanghai line. This was agreed to, and the completion of the purchase and providing the money was saddled upon the Viceroy of the province—an old-fashioned man in his ideas, who hated bitterly all western innovations. But Viceroy Shen was wily in his ways; he knew that his friend, the Governor of Formosa, was applying at Pekin for permisson to lay down a small line from his port, to some coal mines near, and he arranged to use his influence to obtain the permission, provided the Formosa man agreed to purchase the Shanghai railway material. The permission was obtained, and when the completion of the purchase was effected, all traffic was stopped, the rails and sleepers pulled up, bundled in neat parcels, the rolling stock packed in cases duly labelled with blazing dragons, and shipped to Formosa, being well insured by the wily Chinese. Meantime, the Governor of Formosa was promoted elsewhere, the ships were lost, the locomotives tumbled into the mud of Formosa harbor on landing, where they remain to this day; every one got paid and did well!

So ended the little line, but it had told its tale, sowed the seeds that are certain to crop up in time, and the rumors that have since been about, probably indicate the inherent vitality of the enterprise. During the year the railway was in operation, one slight fact is illustrative. Where there had been a hundred Chinese cabbies or Queritshea men before the railway opened, there were a thousand at the close, radiating from every little station on the line, and pouring in traffic. A rough survey was made at a line between two great emporiums of traffic, and the engineers in their report strongly urged that if the concession were obtained, four lines of rail should at once be provided for.

China contains a population of over 400,000,000, and it would be difficult to show that the inhabitants of all the countries using railways put together, amount to half that sum. The total length of constructed lines may be taken at about 300,000 miles, of which England, France, and Germany each possess from 20,000 to 30,000, and the United States something like 130,000. Now, a hundred miles of railway takes some 15,000 tons of iron and steel for its construction, besides a large quantity of rolling stock. The English make of rails last year was 785,000 tons, the capacity of our mills probably 1,000,000 tons, so that there is but a small gap between the present stagnation and the different state of things that would exist, could we but increase the demand up to the power of supply. To remove the antiquated objections of the Chinese Government is the sole difficulty in the way to opening to the world a magnificent market, in the trade of which England has energy and vitality enough to secure the lion's share.—London *Architect*.

The Sewage Disposal of Berlin.

La Semaine des Constructeurs quotes from M. Durand-Claye a brief account of the present condition of the system in use at Berlin for disposing of sewage. As is well-known, Berlin had until within a few years no real sewers, and its entire system of drainage is the result of very recent study and experiment. The site of the city is nearly level, and it lies in the midst of a flat, sandy plain, far from the sea, so that no natural facilities existed either for collecting or disposing of the sewage, and it was necessary to weigh the advantages of all known methods with the greatest care in order to choose the one which would be most effectual and economical. Almost from the first it was decided to dispose of the water liquids of the city by irrigation, and although the temptation to reduce the amount of liquid to be dealt with by allowing surface waters to run into the river must have been great, the sewers were finally planned to take all the street washings, as well as house and manufacturing wastes. The natural fall obtainable being very small, it was necessary, in order to secure proper flushing, to divide the area of the city into twelve sections, each having its own network of sewers, discharging into separate receiving reservoirs, from which the liquid is pumped into the conduits through which it flows to the purifying fields. The main sewers are constructed of brick, with branches of vitrified pipe, and all portions are ventilated by numerous openings.

The planning of the irrigation fields seems to have been quite as difficult a matter as that of the sewers. Unlike the purifying tracts of Paris and Edinburgh, the district which the Berlin engineers were obliged to use was not only low and flat, but presented a sandy upper soil about three feet deep, overlying a bed of impermeable clay, which kept the water which fell on the plain close to the surface, making the ground marshy during the greater part of the year. Such ground as this was very unfit for purifying large quantities of sewage, and it was foreseen from the first that unless a large area were used, saturation with foul liquids would soon take place, and the land would become pestilential.

After careful investigation and experiment, it was decided that 4,000 cubic meters ought to be about the maximum amount of sewage delivered annually on each acre of land. This is a much smaller dose than is usually allotted to sewage farms, and the city authorities were in consequence obliged to secure a considerable territory for its operations. They were prudent enough to do so at the outset, and the irrigation farms now include 13,000 acres, or about an acre for every 84 inhabitants of the sewered part of the town. Only about half of this is, however, at present under irrigation, the rest being kept in reserve for future use, or as fallow ground to be employed in alternation with the fields now irrigated. As fast as the irrigation pipes are laid, subsoil drains are put in, to maintain the filtration through the soil, and the subsequent aeration, which experience has shown to be essential to success in sewage farming. The outfall from the subsoil drains is into the natural watercourses, which flows sluggishly into the North Sea, and it was found at first that the movement was so slow that the ground became clogged with sewage; but a thorough clearing of the streams and the removal of the weeds which choked them, soon freed the passage, and the soil is now easily kept in proper condition. We have no details of the mode of cultivation in use on the irrigated land, but it appears that during the last year the cost of carrying on the operations, which has hitherto been done by the city officials, was about £85,500, and the receipts from sales of produce about $76,500, the deficit of £9,000 representing the cost of the disposal of the wastes of nearly 1,100,000 people, besides the rainfall and street-washings of a large city. Now, however, the efficiency of the system having been established, negotiations are in progress with farmers for the lease of portions of the irrigated fields, and much of the territory has already been taken up, at prices which will bring to the city an annual profit instead of a deficit.

It seems probable that the German engineers, using the record of the experience of others with the care and thoroughness characteristic of their race, have succeeded to an unusual degree in securing the benefits usually sought in the introduction of sewerage systems, bnt one is hardly prepared for such surprising results as those which M. Durand-Claye describes. According to him, the recent health statistics of the city show that in the portions not yet connected with the sewers there has been within a given time, we suppose a year, one case of typhoid fever to nine and three-tenths houses, and one death from the disease in every forty-third house; while in the sewered districts there was in the same time only one case of the fever to forty-nine and three-tenths houses, and one death from it to 137 and five-tenths houses. It must be remembered that Berlin is above all others a city of great apartment-houses, the average number of persons to a house being 58, so that these figures do not in either case show an extraordinary mortality from typhoid fever, but it is remarkable that the simple connection of the buildings with the sewers, without any change in the character of the drinking-water used in them should at once diminish by four-fifths in liability of their inhabitants to the disease. In fact, as the interior portions of the city, which are at once the most crowded and the least wholesome, have been the first to be provided with sewers, while the houses in the suburban circle, where the system is not yet complete, would naturally have fewer occupants, and those of a cleaner and better nourished class, it seems quite possible that a comparison of the numbers of individuals attacked, instead of that of houses, would show a still greater difference in healthfulness between the sewered and unsewered districts.

A FEW gallons of printer's ink spread over a newspaper will equal the services of an army of drummers.

NEW ORDNANCE MATERIAL*

The Official Report to the U. S. War Department of

WM. H. BIXBY, CAPT. OF ENG'S., U. S. ARMY.

The following descriptions are taken from a manuscript report upon Sea Coast Fortification in Europe, made to the Chief of Engineers, U. S. Army, by the writer after a personal visit in 1881-2 to the principal fortifications of England, Belgium and Holland.

Many of the so-called new features of modern guns and gunnery are really old, at least in idea, and are really new only inasmuch as they are unknown to the reader or student. In such cases especially, the writer has taken pains to refer to the sources whence he has obtained his information, and where much more valuable data is to be found by any one desiring full details.

In the way of *heavy gun construction* in Europe, the new departure is that toward the construction of wire-wound or ribbon-wound guns.

In the *mounting and manoeuvring of heavy guns*, the new features of special interest are: 1st, the so-called non-recoiling guns, where the carriage either prevents all perceptible recoil of the gun, or reduces the recoil to an exceedingly small amount: 2nd, the so-called muzzle-pivoting guns, which can be aimed and fired in every direction through an embrasure or porthole almost, or quite, as small as the muzzle of the gun itself; 3rd, the disappearing guns whose recoil carries them out of sight and to a position where they can be loaded in safety; and 4th, the under-cover loading apparatus by which the cannoniers are protected while loading, although the mass of the gun remains exposed. In all these four cases, the peculiar features belong to the gun's carriage more than to the gun itself, and they will be described therefore as gun-carriages.

The new features of special interest in the way of projectiles are projectiles of chilled-iron with corrugated or ribbed points; and projectiles of chilled steel.

Amongst new explosives the cheap, violent, safely-transported Gruson powder deserves special mention.

The accuracy of the fire of modern ordnance, and the protection of iron and stone surfaces from dampness, though of minor consequence are interesting and worth notice.

Each of these subjects will be taken up in turn in this article or its continuation.

HEAVY GUNS.

Wire-Wound or Ribbon Guns.—The subject of wire-gun or ribbon-gun construction was examined by the writer during his stay in England, and the Armstrong works at Elswick, Newcastle, were visited partly for this purpose. The result of such study showed him that such construction involves no principles newer than 1855. The *present* success of the wire-gun seems due principally to the fact that its construction has been directed since 1878, by the Elswick Works, backed by plenty of money, technical skill, the best machinery, and close attention to details.

Wire-wound guns covered with melted bronze, were invented by Dr. W. E. Woodbridge, of the United States, in or before the year 1850[1]. Other wire-wound guns, without any melted bronze covering, appear to have been separately, independently, and almost simultaneously invented also in England, in 1855, by Capt. Blakely, Mr. Longridge, and Mr. Bruno[2]. The construction of these guns has been thoroughly elaborated by Mr. Longridge before the Institution of Civil Engineers and Royal United Service Institution in the valuable article just referred to.

In 1868, long after the original patents had expired, the Armstrong works took up the construction of the gun with excellent results. A 6-inch wire gun was built in 1879; and a 10.24-inch 21-ton gun in 1881; and 12-inch 40-ton and 13-inch 44-ton guns have been designed[3].

These guns may be summarily described as composed of an inner steel tube wrapped with successive coils of steel ribbon, the tension on each concentric layer being adjusted during the winding so as to agree with results demanded by previous calculation. The 13-inch 44 ton gun is expected to give a muzzle energy of 27,500 foot-tons, or 622 foot-tons per ton of the gun. It is said that the Armstrong wire-wound gun can be made for half the cost of the ordinary Armstrong gun; Mr. Longridge stated in June, 1879 that he had received offers from manufacturers to make a steel wire-wound 100-ton gun on his principles[4] for from $17,500 to $20,000 per gun. This price is about two-thirds of the cost of Italian steel-hooped cast-iron guns, one-third that of the Woolwich gun, one-fourth that of the ordinary Armstrong gun, and one-eighth that of the Krupp gun.

The following details as to the actual results given the 10.24-inch wire-gun were received from the Elswick works in June, 1882.

RESULTS OF EXPERIMENTS WITH THE 10.236-INCH WIRE-WOUND GUN.

Total weight of gun	21 tons 4 cwt.
Total length	317 inches.
Total length of bore	300 inches.

Rounds.	Weight of Charge in pounds.	Weight of Shot in pounds.	Initial velocities.	Pressures in Chamber.	Total Energy of Shot in foot tons.	Remarks. Prismatic powder test.	
1	230	501½	1858	19.3 18.5 8 14.7	12005	48	
2	240	495	1893	20.4 18.9 8 15.1	12300	48	
3	"	497	1928	23.9 22.4 8 17.8	12810	70	
4	250	502	1930	22.5 22.5 8 20.0	12966	48	
5	260	500	1943	30.0 29.1 8 28.4	13089	48	
6	"	504	1944	20.1 20.5 8 19 4	13207	67	
7	"	502	1940	21.4 21.2 8 22.1	13101	48	zinc tube
8	280	501	2012	21.9 8 —	14063	67	"
9	300	498	2076	23.1 22.5 8 —	14882	67	"
10	280	504	2011	22.3 22.5 8 19.5	14133	48	
11	290	503	2020	23.0 24.2 8 20.5	14232	48	
12	"	501	2056	24.1 24.4 21.2	14685	48	
13	280	502	2090	28.7 27.9 8 20.4	15205	70	
14	290	503	2146	28.7 30.1 8 20.8	16062	70	
15	300	502	2105	34.5 35.1 8 30.8	15424	48	
16	260	500	1974	19.5 19.3 8 —	13510	67	

As a comparison between the old and new guns, it is well to add here that the ordinary Armstrong 10-inch 25-ton gun 26 calibers long (not wire-wound) uses a 400-powder cartridge and pressures of about 17 tons per square inch in the chamber and fires a 400-powder shot with 1,950-feet-per-second velocity, and 10,564 foot-tons of total energy.

(TO BE CONTINUED).

*Published in ENGINEERING NEWS by permission of the War Department.

[1]See Dr. Woodbridge's letter of 30th July, 1850, to the U. S. Secretary of War as published in pages 159 to 161 of Report of U. S. Chief of Ordnance for 1872. The Woodbridge gun is fully described in the Annual Reports of the U. S. Chief of Ordnance for 1872 and 1882, as well as in some of the intermediate years; and also in the report of the Getty Board on Heavy Ordnance and Projectiles, Washington, 1882.

[2]See Presidential address of Sir Wm. Armstrong before the Institution of Civil Engineers, England, 1882. See also, Longridge; Construction of heavy ordnance, pages 283 to 428, Vol. 19, and page 171 to 258, Vol. 56, Proceeding Inst. Civ. Engrs., England; also, pages 932 to 964, Vol. 23 Proceedings Roy. Un. Service Inst., Eng. 1879.

[3]For full description of gun and its manufacture, see pages 227 to 237, plates 4 to 7, 9 to 14. Rept. U. S. Chief of Ordnance for 1882; and also, Rept. of Getty Board on Heavy Ordnance, Wash., 1882.

[4]See Longridge, pages 922 to 964, Vol. 23, Roy. Un. Serv. Inst., for 1879; and especially 83 pps. of paper to 1958, Vol. 78 of Proceedings of Institution of Civil Engineers, England for 1883-4.

Wages in "The Good Old Times."

The following are the rates of wages fixed by the magistrates and justices of the peace for the county of Chester at a meeting held at Chester, England in April, 1597:

	By the year, with meat and drink. £. s. d.	By the year without meat and drink. £. s. d.	By the day with meat and drink. £. s. d.
A Smith	1 11 8	5 0 0	0 0 2
A Wheelwright	2 0 0	5 10 0	0 0 2½
A Ploughwright	1 10 0	5 0 0	0 0 2
A Master Carpenter	2 13 4	5 13 4	0 0 4
A Servant Carpenter	1 0 0	3 10 0	0 0 1
A Joiner	1 10 0	4 0 0	0 0 2
A rough Mason	1 6 2	5 0 0	0 0 2
A Plasterer	1 0 0	5 0 0	0 0 2
A Sawyer	1 8 0	4 10 0	0 0 2
A Limemaker	1 3 0	4 6 8	0 0 2
A Bricklayer	1 0 0	4 0 0	0 0 2½
A Brickman	1 6 0	4 10 0	0 0 2½
A Tyler	1 5 0	3 18 4	0 0 2
A Slater	1 6 0	4 0 0	0 0 2
A Millwright	1 3 4	5 10 0	0 0 3
A Tilemaker	1 10 0	4 0 0	0 0 2
A Linen Weaver	1 0 0	4 6 0	0 0 1
A Turner	0 16 0	3 0 0	0 0 1
A Woolen-weaver	1 8 0	3 12 8	0 0 1
A Miller	1 10 0	4 0 0	0 0 2
A Fuller	1 6 0	3 18 4	0 0 1½
A Walker	1 3 4	4 0 0	0 0 1¼
A Thatcher	1 0 0	4 0 0	0 0 1
A Shingler	1 10 0	4 0 0	0 0 2
A Shearman	1 0 0	3 13 4	0 0 1½
A Dyer	1 6 3	3 13 4	0 0 1½
A Hosier	1 3 0	3 10 0	0 0 1
A Shoemaker	1 10 0	4 0 0	0 0 2
A Tanner	1 6 0	4 0 0	0 0 1
A Pewterer	1 0 0	3 13 4	0 0 2½
A Baker	0 16 0	3 10 0	0 0 1
A Brewer	1 0 0	3 10 0	0 0 1¼
Glovers	1 6 8	3 16 0	0 0 1
Cutlers	1 7 0	4 10 0	0 0 1½
Saddlers	1 5 0	4 0 0	0 0 1½
Spurriers	1 5 0	4 0 0	0 0 1½
Capps	2 0 0	3 10 0	0 0 2
Hatmakers	1 10 0	4 10 0	0 0 2
Bowyers	1 8 0	4 0 0	0 0 2
Fletchers	1 0 0	3 10 0	0 0 2
Arrow head makers	0 15 0	3 10 0	0 0 1
Butchers	1 6 8	3 10 0	0 0 1
Cooks	1 0 0	3 5 0	0 0 1
Bailiffs, Husbandry	2 0 0	4 0 0	0 0 3
Mowers of grass	—	—	0 0 4
Taskers	—	—	0 0 4
Reapers	—	—	0 0 2
Mowers of Corn	—	—	0 0 4
Best Servants	1 0 0	3 10 0	—
Second Sort	0 10 0	2 10 0	—
Third Sort	0 8 0	1 16 0	—

This meeting was held, and these prices of labor settled, on account "of the dearth and scarcitie of things at this present tyme." The prices in Windsor market then were:—Wheat £3, 9s. 6d. the quarter, and malt £2. 6s. 4d. the quarter, according to the audit books of Eton College. Beef sold at 1s. 6d. the stone of 3 lb.; Dutch cheese at 3½d. per lb.; Suffolk cheese at 2½d. per lb.; barley for poultry at 10d. per peck; a bushel of oatmeal at 5s. 8d.; best beer in October at 5s. 4d. per barrel; small beer at 2s. per barrel; and in December, best at 6s., small at 4s. 4d.—*Contract Journal.*

ITALIAN ASPHALTE.—Since 1874 there has been a small but regular trade between Ancona and Great Britain in Abruzzi asphalte, and the traffic could be further developed if the mines, part of which are in the hands of British capitalists, were better known. England consumes prepared asphalte only, whereas several thousand tons of ordinary rock are exported to Russia every year, and there crushed and reduced to powder by machinery. The powder is eventually made into mastic, or the bitumen extracted. The Abruzzi asphalte will bear comparison with that of Germany, France, and Switzerland, as it has the advantage of being suitable for extreme climates. After many years' experience in Italy, it has been proved that neither the hot sun of Naples, nor the ice and snow of Milan will affect the roads made of Abruzzi asphalte, which in fact will resist any temperature. To this advantage the low price of the article must be added.

Experiments with Bolts and Screw-Threads.*

BY MAJOR WILLIAM R. KING, U. S. ENGINEERS, CHATTANOOGA, TENNESSEE.

My attention was drawn to this subject just twenty years ago this month, when I was detailed to rebuild one of the bridges in Richmond that had been burned during the evacuation. We took possession of the Tredegar Iron Works, rolled the iron for the bolts and rods, made castings from old shell and other scrap, borrowed the necessary timber from the remains of the navy-yard, and rebuilt Mayo's Bridge, 1400 feet long, in about six weeks, the soldiers doing most of the work. Although I had taken special pains in proportioning the bridge, and had introduced what Holley has designated as a suitable "factor of ignorance," I was not at all satisfied of the stability of the bridge when completed, on account of the evident weakening of the principal rods by cutting coarse "standard" threads upon them, and I was greatly relieved of anxiety when a few years later an unprecedented flood in the James River picked up that bridge and carried it bodily out upon the bosom of Chesapeake Bay.

The matter was again forcibly suggested a few years later, when I was investigating the subject of armor-plating. I found that bolts were a great source of weakness, and, as a general rule, especially in all the earlier experiments, when any of the armored targets were struck by heavy projectiles, the result was a perfect hailstorm of bolt-ends, nuts, and washers. In fact, it may almost be stated as a rule, that in all similar engineering work the bolts are the weakest part of the structure. This is perhaps due to the fact that we almost always look at the side rather than at the end of a bolt, which makes about 30 per cent. difference in the *apparent* strength. In order to strengthen a chain we must strengthen the weakest link, and as cutting away too much metal for the screw-thread weakens bolts, which in turn are themselves sources of weakness, it is evident that we must begin at the thread. If the thread is cut deeper than is required to prevent stripping, it must weaken the bolt and in a most insidious way, for it is the very method taken by the blacksmith to break iron or steel bars; and it should be noted right here that the standard thread is cut much deeper than the blacksmith nicks his bars.

Without going into the mathematical work by which the facts were proved, it may be stated that, in connection with the armor-plate investigations already referred to, I found theoretically: first, that, with a perfect-fitting thread it makes no difference in regard to the strength of a bolt-thread how fine it is made, since the length of thread increases just as fast as its strength of cross-section diminishes; second, that with such a thread one-fifth of the diameter of the bolt is a sufficient thickness of nut to prevent stripping; third, that about one-fifth the cross-section of the bolt would be a sufficient cross-section of nut to prevent bursting. These dimensions are very far within the limits to which any one one would think of carrying the reform, but they indicate that there is a very broad margin between existing practice and safe economy.

The advantage of having every part of a structure of a strength proportional to the strain upon it is not generally appreciated. The "Deacon's One-hoss Shay" was more of a reality than is generally understood. *A beam may be actually strengthened by cutting away portions of it.* Figs. 1 and 2 represent two little wooden beams, for example, that show how the strength of a beam may be more than doubled by cutting away surplus timber, and leaving all parts strong in proportion to the strain they are required to resist. The same principle applies to bolts.

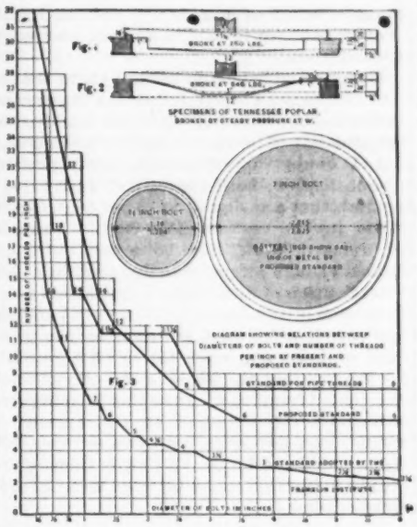
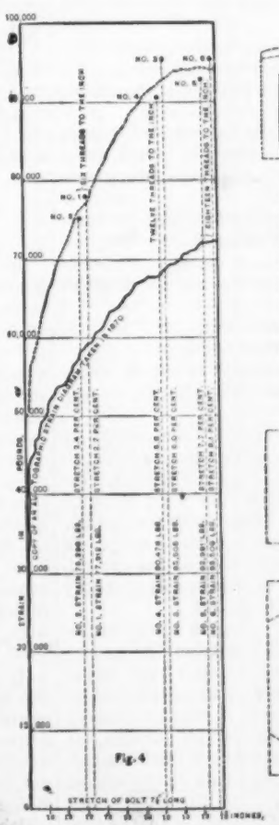


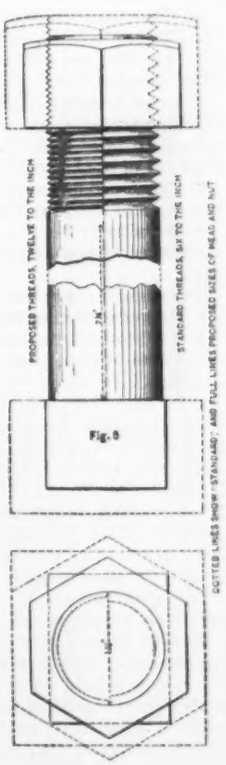
Fig. 1
Fig. 2
Fig. 3
DIAGRAM SHOWING RELATIONS BETWEEN DIAMETERS OF BOLTS AND NUMBER OF THREADS PER INCH BY PRESENT AND PROPOSED STANDARDS.
STANDARD FOR PIPE THREADS
PROPOSED STANDARD
STANDARD ADOPTED BY THE FRANKLIN INSTITUTE
DIAMETER OF BOLTS IN INCHES.

But in such matters actual experiment is the safest—if not the only safe—guide; and fortunately such evidence is available. The following account of one set of experiments is from my last annual report, made in July of last year:

Experiments with Screw-Threads and Nuts.

"Having occasion to use a large number of screw-bolts in building iron-lock gates for the Muscle Shoals Canal, my attention was again directed to the proper proportions of threads and nuts. About fourteen years ago, while experimenting with materials for armor-plating, I became convinced that the 'standard' sizes for V-shaped threads were very much too coarse for nearly all purposes, and that the size of nuts was out of all proportion to the strains upon them, since the bolts themselves would invariably break long before the thread or nut would yield. These facts were briefly set forth in 'Professional Papers No. 17,' printed in 1870, and the practical tests now made have fully verified the conclusion then reached. Four test-bolts were made. They were all from the same quality of wrought-iron, and were forged at the same time. The shanks of the bolts were turned and the heads and nuts were faced up in the usual way, the outside of heads and nuts being left in a rough state. No special care was taken in fitting the nuts. Two of these bolts had the standard threads of six to the inch, and two had twelve to the inch, and all the heads and nuts were made about two sizes lighter than the tables prescribe for 1½-inch bolts. As the fine thread weakens the bolt much less than the coarse one, and must be proportionately stronger, the principal questions to be settled were whether the thread of the fine-cut bolts would strip or the head or nut would give way before the bolt itself would break.





These questions were definitely settled by having the bolts carefully tested on the Government testing-machine at the Watertown Arsenal, which was done by the courtesy of Major F. H. Parker, United States Ordnance Corps.

There was no sign of stripping the thread or bursting the nut in any case, and the coarse threads broke at an average strain of 66,325 pounds, while the fine ones stood 78,400 pounds, or over 18½ per cent. more. The fracture in every case was at the bottom of a thread, as usual, but the fine threaded bolts were elongated 4½ per cent. of their length, while the coarse ones were only stretched 2 per cent., which shows that the 'work' of breaking the former was more than 2½ times as great as in the case of the 'standard' bolts. The tensile strength of the iron was found to be 59,785 pounds per square inch of original section in the coarse-threaded bolts, and 58,495 pounds in the fine ones, showing that the experiments, if anything, slightly favored the standard bolts, and that the results are due entirely to the fact that the coarse threads cut away too much metal; and it is quite probable that even finer threads than those tested, say 16 or 18 to the inch, would give better results.

The importance of the results is evident from the fact that a net increase of about 20 per cent. in the statical strength of bolts and 150 per cent. in their resistance to sudden strains can be made by simply using finer threads, and at least 40 per cent. of the iron in the head and nut can be saved by making them that much lighter. It is certainly a mystery why manufacturers will persist in throwing away metal and labor in making coarse threads which cut away the bolts unnecessarily at their weakest point, and I can only account for it upon the theory that the present scales have been inherited from the coarse blacksmith work of former years, which has been carried into our modern and more refined practice to avoid changing taps and dies. . . ."

It should be stated that the outside of the thread in all these bolts was $\frac{1}{16}$ inch smaller than the body of the bolt, or the latter would have shown greater elongation.

To test the matter still further, I have recently had three more pairs of bolts made, one pair having six threads, one twelve threads, and one pair eighteen threads to the inch; but in all other respects the bolts were as nearly alike as it was possible to make them. They were turned from bar iron 1½ × 2 inches square, so that no forging was required.

*Transactions of the American Institute of Mining Engineers. Read at the Chattanooga Meeting, May, 1885.

The results were still more favorable for the fine thread, for when broken in a hydrostatic press not a single nut showed signs of weakness, and the bolts with eighteen threads to the inch showed unmistakably that they were stronger than the others, although they finally yielded by pulling out of the nut—not by stripping the threads, as we generally understand it, but by actually drawing down the size of the bolts until the greater part of threads were disengaged, as can be seen from the specimens.

In Fig. 4 I plotted the strains and corresponding stretch of the six bolts, and, for comparison therewith, a diagram enlarged from an autographic sheet (similar to an indicator diagram), taken in 1870, which is thought to be the first attempt ever made to get a continuous record of the behavior of iron under varying strains.

	Pounds.
The standard bolts broke at an average strain of	76,655
Those with 12 threads at	92,991
Those with 18 threads yielded at	94,248

It will be noticed that the latter were just on the point of breaking when the nut pulled off.

Mean Results.

	6 threads.	12 threads.	18 threads.
Relative tensile strength	1.	1.21	1.23
Stretch	.025	.06	.08
Relative work	.025	.0726	.0984
Or	1	2.9	4

Fig. 5 shows comparative views and sections of the six-thread and twelve-thread bolts. The advantages sought by increasing the number of threads per inch are:

1. At least 20 per cent. additional statical strength.
2. Three or four times the strength to resist impact.
3. The finer threads are easier to cut.
4. They are less liable to work loose.
5. In many cases this practice will take the place of upset or enlarged bolt-ends.
6. In such cases it would have the advantage of filling the hole, or, rather, it would avoid the necessity of making the holes larger than the body of the bolts.
7. There will be a saving of 50 or 60 per cent. in weight of heads and nuts: also in cost.
8. Bolts may be placed closer to angles in structures without chipping out for head or nut.

The disadvantage would be:

1. Cost of changing taps and dies.
2. Additional time required to put on or remove nuts, which, of course, is hardly worthy of notice.
3. In case of bolts frequently removed there would, of course, be a greater loss in strength from wear and rust of surfaces of thread. We have seen, however, that this wear must go on until the No. 12 thread is as fine as the No. 18 thread before the nut will strip. In some cases, like the bolts that secure the cylinder heads of a steam engine, it will probably be best to retain a coarse thread.

The great excess of strength in the ordinary screw-thread is evident from the experience with French breech-loading guns, where the enormous strain due to the explosion of the charge is held by only a fraction (considerably less than one-half) of the threads, the balance being either cut away or not engaged. In a 16-inch rifle, *e, g.*, the strain on the breech plug is about 4,000 tons.

Although the cost of changing to the proposed system would be very great, I believe the country could well afford to buy up all the old taps and dies at their weight in standard silver dollars and destroy them, just as they do obsolete dies at the mints.

Some might think it best to wait for the adoption of the metrical system before taking action in this matter, as another change would, of course, be necessary in that event; but I think this would be a mistake. The metrical system is making very slow progress in this country, and its practical use would reach everybody and send them back to their school books, while this change would simply affect manufacturers of machinery, etc., and only require changes in tables, gauges, and other special tools.

If any reliable person should claim that he had discovered a method of saving 10 per cent. in the cost of producing pig-iron it would arrest the attention of the entire pig-iron community: but I doubt very much whether a positive demonstration, both theoretical and experimental, that a saving 20 to 60 per cent. can be made in the cost of more highly wrought or finished work, like bolts and nuts, will attract enough attention to secure even a fair investigation of its merits. I should feel more hesitation in advocating a reform of so ancient and conservative an institution as the standard of bolts and screw-threads if it were not for the fact that the world is full of just such antiquated humbugs. Take the Birmingham wire-gauge for example, or our system of weights and measures, with two or three different pounds and tons, and no system whatever in fixing the ratios between units of different orders.

The standard for threads, which I have indicated by a broken line (see Fig. 3), with a diagram of pipe-threads and the Franklin Institute Standard, is merely suggested for consideration, and, of course, should not be adopted without careful experiment with all sizes of bolts, to see that the figures given are those best suited for each bolt. I have endeavored, without attempting any great nicety to fix upon the simplest combinations of numbers that will give about double the standard number of threads to the inch and avoid fractional numbers of threads, so far as possible.

Instead of introducing such complications as $2\frac{7}{8}$ or $2\frac{5}{8}$ threads to the inch, I would suggest that whole numbers be fixed for each $\frac{1}{4}$-inch of bolt diameter, and then let each of the intermediate sizes of bolts have the same number of threads as the bolt next below it in size.

A New Torpedo.

Gen. Berdan has been for some months perfecting a new torpedo in Constantinople. The invention is devoted to an important feature of torpedo warfare. The risk run by powerful and costly war ships have caused the adoption of stout nettings, intended to arrest the torpedo and cause its explosion before reaching the hull. Hobart Pasha once said in the *North American Review* that the torpedoes employed by the Russians against him were only successful in two instances, and then through a neglect of the precautions he had ordered. The Turkish gunboat blown up on the Danube by a spar torpedo did not have a crinoline protection of spars and ropes, which would have shielded her completely. Some war vessels employ a stout wire crinoline, which can be let down from their sides when in the presence of an enemy.

Gen. Berdan's device is intended to destroy the usefulness of these torpedo guards. Its characteristic feature is in employing two torpedoes instead of one. In the first method of using it, one torpedo blows a hole in the net, and through this the other passes on to strike the ship itself. In the second method, which is the one upon which stress is laid, the first torpedo is made non-explosive. When it strikes the net the follower dives under the net and explodes against the vessel. The contrivance employed for producing this result is simple. The second torpedo is partly dragged by the first with a rope or wire cord. The first torpedo having struck the netting, the other goes on by its own momentum, but the cord slackens and "lets fall a species of rudder ledge or trap underneath the center of the second torpedo. This projecting ledge being caught by the water as the second torpedo advances, is sufficient to drag it down into the water, where at an angle of 15° it dives under the ship's netting. Having gone the length of the towline the torpedo will be brought sharply up to the ship's bottom, and the explosion follows. When the ship is not protected by nets the only change is using a shorter towing line. The rear torpedo does not float on the surface, but is balanced to sink a few feet below water, and so to escape destruction from the ship's shot."

The exploding torpedo is to be 31 feet long, 21 inches broad at midship section, and 31 inches deep, with a displacement of 2,800 pounds. Its charge is to be 220 pounds of gun cotton or dynamite, fired by impact. The motive power of the torpedo is gained by the combustion of three rows of four 100-pound rocket tubes filled with rocket powder; and this powder is compressed with a mixture of clay, which secures regular burning. The gas generated by combustion of the rocket powder rushes through a nozzle, and acts upon several compartments of a turbine which revolves the torpedo's screw, thereby increasing the power. The motive power will carry the torpedo a mile, the time employed for this distance being about $2\frac{1}{2}$ minutes.

The steering of the first torpedo, which directs the second, is effected by two grooved wheels, with a mile of fine plaited linen cord passing over dynamometers. Pressure is put on by friction breaks worked by two levers. The first torpedo runs just under the surface of the water, and a small disk a few feet above is used to aid in steering it, this being lighted at night by a lamp reflecting rearward.

Northwestern Labor Prices.

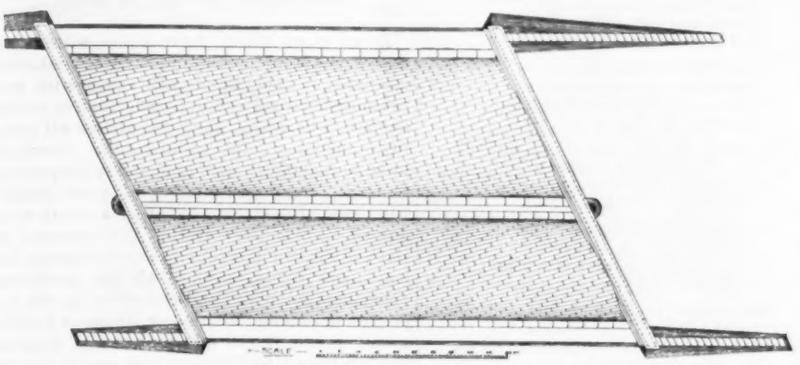
	Chicago, Ill.	Joliet, Ill.	Detroit, Mich.	Dubuque, Ia.	Des Moines, Ia.	Fargo, D. T.	Hastings, Neb.	Minneapolis.	St. Paul.	Omaha Neb.	Sioux City, Ia.	Cheyenne, Wy.
Bricklayer	$4.00	$3.00	$3.00	$4.00	$4.00	$3.50	$4.00	$4.00	$4.00	$4.50	$4.00	$ 6.00
Bricklayer (Front.)	5.00	4.00	4.00	5.00	4.50	4.00	4.50	5.00	5.00	4.50	4.50	10.00
Carpenter	2.75	2.50	1.50	2.75	2.50	3.00	2.25	2.25	2.25	3.00	2.50	3.50
Cabinetmaker	3.00	.....	2.00	.....	2.50	.....	2.50	3.00	3.50	3.00	.....	3.01
Finisher	3.00	.....	3.00	.....	2.50	.....	2.50	3.00	3.00	2.75	.....	3.50
Gasfitter	2.50@3.00	2.50	2.50	2.50	2.00	3.50	3.00	3.00	3.00	3.00	3.00	3.25
Laborer	1.75@2.00	1.75	1.00	1.50	1.75	1.75	1.50	1.50	1.50	2.00	1.50	2.50
Painter	2.50@3.00	2.50	3.00	2.50	2.25	2.50	2.50	2.50	2.50	2.50	2.50	3.00
Glazier	.....	2.00	3.00	.....	2.25	3.00	.....	.....	.....	.....	.....	3.50
Plasterer	4.50	3.50	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.00	4.50
Plumber	4.00	4.00	2.50	3.00	3.00	.....	3.00	3.00	4.00	4.50	4.00	4.00
Stonemason	3.50@5.00	3.50	3.50	3.50	3.50	.....	3.00	3.00	4.00	4.00	3.50	5.00
Carver	4.50@5.00	4.00	4.00	5.00	5.00	.....	.....	4.00	5.00	5.00	.....	4.50
Stonecutter	4.00	3.50	2.00	3.50	4.00	.....	4.00	4.00	4.00	4.00	.....	5.50
Stonecutter	4.00	3.00	2.50	4.00	4.50	.....	3.00	4.00	4.00	4.00	.....	4.00
Roofer (tin)	2.75	2.50	2.50	2.50	2.50	3.00	3.00	2.50	2.50	.....	.....	3.25
Slater	3.00	.....	3.00	3.50	2.00	.....	.....	3.00	2.50	3.50	.....	3.25
Stairbuilder	3.25@3.75	4.00	3.00	.....	3.00	5.00	.....	2.50	2.50	3.50	.....	4.50
Steamfitter	3.50	3.00	.....	3.50	3.25	3.00	3.50	3.50	3.50	4.00	.....	3.50

—*Northwestern Architect.*

"MIXED."—A citizen of Hawley, Minnesota, writes to the *Moorhead News*: "The first surveyor surveyed one-half of the village into the adjoining town north. The second surveyor brought her all back in good shape. The third surveyor couldn't find any streets, and the fourth surveyor couldn't find the village. Now the trouble is, we want to know whether we are in Minnesota or Dakota."

The Arches of the Seventh Street Improvement, St. Paul, Minn.

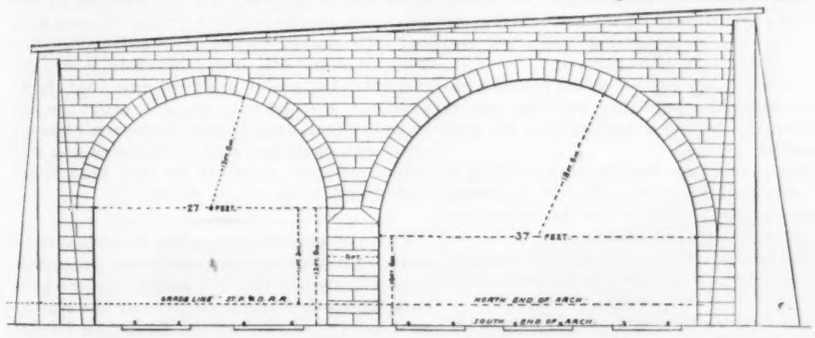
The just completed Seventh Street Improvement, in St. Paul, Minn.. is notable as the heaviest piece of public work ever attempted in that city. It consists of an iron bridge 300 feet in length over the Northern Pacific R. R. and the St. Paul, Minneapolis and Manitoba R. R. at Trout Brook Valley; the two oblique or skew arches, illustrated, over the St. Paul & Duluth R. R.; the Phalen Creek Culvert, 320 feet in length; the embankment across



PLAN: SEVENTH ST. OBLIQUE ARCHES, ST. PAUL, MINN.

Phalen Valley, 640 feet long and 80 feet high, built to the full width of the street—66 feet—and containing 196,000 cubic yards of earth, and the grading of Seventh street, with the cross streets, making a total of 235,000 cubic yards of excavation.

In the iron bridge, 220 feet were built by the Northern Pacific R. R. Co., the remainder of the work was done by the city within the last two years. The embankment was made with material brought in dump-cars from a distance of one-half to three-quarters of a mile



END-VIEW: SEVENTH ST. OBLIQUE ARCHES.

down a descending grade of 5 feet per 100 feet; it was excavated by an Osgood & McNaughton steam excavator of the largest size.

The most interesting part of this improvement, to engineers, lies in the double oblique arches over the St. Paul and Duluth R. R., which were designed by and erected under the supervision of Mr. W. A. Truesdell, the engineer of the Seventh Street Improvement.

At this point, Seventh street, which is 66 feet wide, crosses the right-of-way of the railroad, 70 feet in width, at an angle of 63° 28′. The tracks are 47 feet below the street grade. The smaller arch is 27 feet direct span, and the larger 37 feet, and each one is 124½ feet in length with wing-walls at the ends, from 47 to 58 feet long. Both arches are "full center," and are built on the helicoidal method with spiral courses. The smaller arch contains 62 impost stones and 754 arch stones. The latter are of uniform size and dimensions, except the ring stones, and are 5 feet 8½ inches long. The large arch has 48 impost stones and 900 voussoirs, varying in length from 39 feet inches to 4 feet 11 inches, most of them being of the latter size. The total number of cut stones is 1764.

Work upon these arches was commenced in September, 1883, by M. O'Brien, contractor, of St. Paul, who completed the abutments and center pier to the springing line in May, 1884. The work was then continued by McArthur Bros., of Chicago, together with other work on the improvement. The centers were erected and the arch-stones laid by October 15, 1884, and the masonry entirely completed in November, and the Phalen creek embankment at once carried over so that traffic could cross by the middle of December. In constructing the centers over 100,000 feet B. M. of timber were consumed.

Both arches were built without interrupting the continuous railroad traffic beneath them. The centers remained in place all the last winter and were removed in May, 1885. The abutments, center pier and wing-walls were built of St. Paul limestone, and the remainder of the work of magnesian limestone from the quarry of W. B. Craig & Co., of Mankato. The 1764 voussoirs and impost stone were quarried, cut and laid in 90 days.

No especial difficulty was experienced in either cutting or laying the arch stones. There was a little trouble at first in impressing upon the stone-cutters the necessity of accurate work with the patterns, but after that was done the work went smoothly. A cutter could dress one stone per day, and though this was the first arch-work of this nature attempted in the Western country, the final cost was little more than that of two similar right-arches. The total cost of the Seventh Street Improvement, exclusive of the part of the iron bridge built by the N. P. R. R., was $202,000.

The arch stones were laid on the centers without difficulty—in horizontal rows—on both arches simultaneously. The coursing joints were marked on the lagging, which were guides for the masons in bedding the voussoirs. When the last row was reached at the crown of the arch, the stones fitted to their place and were grouted in. On the removal of the centers, the following spring, the voussoirs were found to have fitted remarkably well. The joints were ¼ inch, which proved to be the correct size for that kind of work. Utica cement was used, mixed one to one with sand.

John Swinton's Cure for "Hard Times."

"But it appears labor is not needed on farm, in workshop or in factory, because machinery has taken the place of it, and there is *too much*, alas! produced already. Is it not, then, clear to every thoughtful observer that if idle men have any right to life or to a foothold on the earth, their labor must be accepted in other ways than in producing in mill and mine, in field and forest, these primary vital necessities of food, fuel, raiment and shelter?

How? Why, in vast works of public utility and adornment;—in establishing technical schools where young men may receive thorough, practical instruction in the mechanical arts and trades,—quite as important and necessary, one would suppose, as the supporting of military and naval academies where they are taught the arts or warfare and destruction;—in building great national highways and canals;—in bridging and tunneling the rivers;—in tunneling, ay, and *removing* mountains;—in improving channels and harbors and clearing away obstructions and dangers to navigation; in reclaiming the swamps and waste places of the earth and making the "desert blossom as the rose;"—in having more macadamized roads; —in having cleaner streets, better paved, better sprinkled, better lighted, better policed;—in having more and better docks, more and better sewers and drains, more and better public baths, more and better acqueducts, reservoirs and drinking fountains of clean, cool, wholesome water;—in having more public parks, well-kept breathing spots of beauty and delight;—in having more public schools, libraries and hospitals; in planting trees, vines and flowers by the wayside; in making two blades of grass grow where one grew before;—in short, in doing ten thousand things which might be done if men and women would but think so ("ay, there's the rub",—to help forward the millenium and make this old earth a paradise.

How business would boom! No grumbling about hard times then, whatever else we might find to grumble at."—*John Swinton's Paper.*

A USEFUL INSTRUMENT.—An ingenious instrument for ascertaining the distances of accessible and inaccessible points from the observer and from each other has been invented by Dr. Luigi Cerebotani, a Professor of the University of Verona. This apparatus consists mainly of a pair of telescopes mounted on a stand and fixed on a tripod for use. The telescopes are both brought to bear on the object, and a reading is then taken from a gradulated scale on the instrument, which, compared with a set of printed tables gives the distance. By this means the inventor obviates the necessity for the base line, which has hitherto had to be laid down in these operations, and he dispenses with all trigonometrical calculations. Distance can be measured between the far-off objects, and by means of a sheet of paper fixed on a drawing board a rough plan of the country under measurement can be sketched. In the same way the distances of ships at sea or of moving objects on land can be determined. The apparatus appears to be well adapted for land surveying, and particularly for military purposes. In fact, it is stated to have been already adopted in the German army in the latter connection, and it is about to be tried by the authorities of our War Department. A practical trial has been made with this instrument on the Thames Enbankment, when its varied usefulness was demonstrated.

Clinker Brick.

A further communication upon the utilization of clinkers has appeared in the *Génie Civil*. M. Gouvy has described the treatment of clinkers in a factory in Meurthe-et-Moselle. The clinkers from all the furnaces of the establishment are passed through a revolving screen which separates them into dust, nut size and large pieces. The dust is used in brick-making, and the nut size is washed in order to recover the small pieces of coke mixed with it. The coke saved in this way is equivalent to from 4 to 5 per cent. of the total consumption of coal in the furnaces. The dust already mentioned is ground up in a mortar mill with slaked lime, in the proportion of ten to three, and the mixture is pressed into bricks by a machine. These bricks are merely air-dried, and are capable of being used for partition walls or any position in which they are not subject to heavy loads. About 2,500 bricks are made from a cubic meter of lime, and the cost of the bricks (not counting the clinker dust as of any value) is about 24 cents per 100. The bricks gain strength with age, and should be made six or seven months before use. A great proportion of the buildings of the works has been constructed of this material. The machine used to compress the bricks is a specially designed apparatus consisting simply of a brick mould for the mixture, placed in a frame under a monkey weighing about 200 pounds, which, like that of a pile-driver, can be raised to the top of the frame and dropped upon the mold. A belt and pulley give continuous revolution to a shaft across the top of the frame which carries a drum, and the monkey is raised simply by the workman holding on the fall of a rope which is made fast to the monkey and passes over the drum. By this means the molder can graduate the force of the compressing blows of the monkey upon the mould by loosing the rope at any desired height. The block, after having been moulded, is removed by a foot lever raising it out of the mould. A man and a boy are sufficient to attend to the machine.

A Substitute for India Rubber.

Attention has again been drawn to this subject by the publication of the report of the Government botanist of British Guiana on balata and the balata industry. This substance is obtained from the bark of the bullet tree, found in the West Indies and the northern regions of South America. The tree is a large one, grows chiefly in marsh land, is said to yield freely, though the supply is limited. Balata commands a higher price than gutta-percha, and has the advantage of changing but slowly when exposed to the air and light. Moreover, it is somewhat softer at ordinary temperature and is not so rigid in the cold. It is not liable to stretch under tension, and hence is said to be "unequaled" for belting. The statement is made that collecting balata is known only as a regular industry in Berbice, but we are informed that an American firm have acquired a grant of several hundred thousand acres for the purpose in Dutch Guiana. Operations thus far have been confined to the banks of the rivers of Guiana, the collectors rarely penetrating more than a mile or two into the forests. One American firm of manufacturers are quoted as affirming that the balata is "the best gum in the world," and there seems little cause to doubt that a very useful substitute has been hit upon. And yet balata is hardly new to the arts, having been brought to notice as superior to india-rubber or gutta-percha in 1862. Possibly the tree is as susceptible of regular cultivation as cinchona or coffee. It is said that the insulating properties of balata are very superior.

ENGINEERING NEWS, Three Months for One Dollar.

In the Civil Service.

From the Brooklyn Eagle.

It was a civil service clerk,
A happy man was he,
For under the rules from morn till dark
He must serve his coun-ter-ee.

With joy he hastened to his home,
He hugged his children three,
He kissed his wife and said "Hurrome!
I'm passed successful-lee!

"They asked me, "Where was Homer born?"
And then they bade me name
The man who led the hope forlorn
At the battle of Alicumpane.

"I gave a list of the English kings
From William down to James,
And told the number of Saturn's rings
And Mrs. Southworth's names.

"About Thermopylæ I told:
I named the North Sea bays,
And then I showed them how to fold
A napkin fifteen ways.

"Book III., Æneid, I scanned ten lines,
And I read some of Xenophon;
I explained the Zodiac and its signs,
And the cause of the choleron.

"And I passed with honor and high award,
And I'll stick to my work alway;
I'm to boil the pitch in the navy yard
For a dollar'na half a day."

Loud laughed the clerk, loud laughed his wife
And the children, loud laughed they,
And he stirred the pitch the rest of his life
In a civil, clerkly way.

R. J. BURDETTE.

Law in Relation to Newspapers.

1. Subscribers who do not give express notice to the contrary are considered as wishing to continue their subscriptions.

2. If the subscribers order the discontinuance of their periodicals, the publishers may continue to send them until all arrears are paid.

3. If subscribers neglect or refuse to take their periodicals from the office to which they have been directed, they are held responsible till they have settled their bill and ordered their paper discontinued.

4. If subscribers move to other places without informing the publisher, and the papers are sent to the former direction, they are held responsible.

5. The courts have decided that refusing to take periodicals from the office, or removing and leaving them uncalled for, is *prima facie* evidence of intentional fraud.

6. Any person who receives a newspaper and makes use of it, whether he has subscribed for it or not, is held in law a subscriber.

7. The postmaster who neglects to give the legal notice of the neglect of a person to take from the office the newspapers addressed to him is liable to the publisher for the subscription price.

Specifications for Glasgow Waterpipes.

All pipes above 12 inches diameter to have wide sockets for lead joints, those of 12 inches and less to have principally turned and bored joints, from 5 to 20 per cent. of each size, according to circumstances, having wide sockets. All pipes with wide sockets above 4 inches diameter to have $\frac{5}{8}$ inch for the joint, the pipes of 4 inches, 3 inches, and 2 inches to have $\frac{1}{2}$ inch for the joint. The whole of the pipes to be subject to proof by hydraulic pressure. Each pipe, while the pressure is upon it, must be rapped with a hand hammer from end to end, so as to discover whether there are any sandy, porous, or blown places; the hammer to vary from 4 to 7 lbs. in weight, according to the size and strength of the casting. The whole of the pipes to be cast vertically in dry sand moulds, and to be of uniform bore and uniform thickness of metal throughout without any belts; the whole to be of the best gray metal remelted from the cupola, and to be perfectly free from flaws and defects of every kind. All pipes of 18 inches diameter and upwards, to be cast with the sockets downwards; those below that size with the sockets upwards. All pipes to be carefully coated inside and out with coal-pitch and oil, according to Dr. A. Smith's patent process. The coating to be applied at a proper heat and in a proper manner before any rust sets in, and the operation to be performed under inspection of a person to be appointed and paid by the commissioners.—*J. F. Bateman, F. R. S.*

Compressive Strength of Stone.

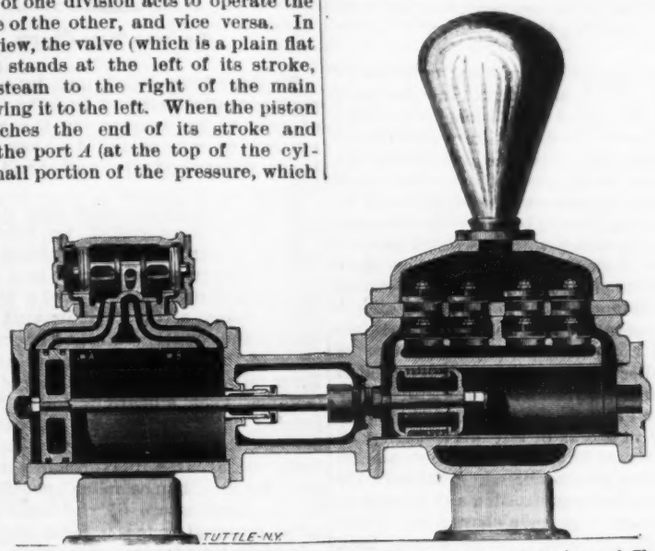
In all cases which have come within my notice, the stone possessing the least cohesive strength, or that which will crush with less pressure than any other, is nevertheless strong enough, when once fixed, for almost all practical purposes. No architectural members have to sustain greater pressure in proportion to their size than mullions of large Gothic windows. The tracery in the great north window of Westminster Hall is now executed in Bath stone, which is remarkable for having the least cohesive strength of all the specimens experimented upon and described in the report on the stone for the new House of Parliament. Some of the mullions of that window are less than 9 inches wide and more than 50 feet high, sustaining not only their own weight but also the whole of the tracery beneath the arch. The eastern window of Carlisle Cathedral, built of a friable red sandstone, is 50 feet high; the mullions are smaller and the the tracery much heavier than in that at Westminster, yet in neither of these examples are there areany symptoms of crushing. The cohesive strength of stones is never more severely tested than during their conversion by workmen from the rough state to being fixed in their final situation in a building. During these operations iron levers, jacks, lewises, and various other implements are applied, frequently without judgment, and with but little regard to the mechanical violence which a stone will bear; therefore it may be considered a useful practical rule that, however soft a stone may be, if it resist the liability of damage until out of the mason's hands, there can be little doubt of its possessing sufficient cohesive strength for any kind of architectural work.—*C. H. Smith.*

EMIGRATION TO CANADA.—The Dominion Government has become alarmed at the great falling off in emigration to Canada, upon which entirely depends the settlement of the Northwest and the success of the Canadian Pacific Railway. Prominent Government officials state that imigration returns for the current year will show a falling off of over 50 per cent. as compared with 1884, and that the total number of immigrants during the past twelve months will not reach over 50,000. So unsatisfactory have the immigration returns proved since January 1, that the Minister of Agriculture has abandoned the publication of monthly statements which for several years have been issued from the department. It was held that the publication of these statements rather prejudiced than encouraged emigration to Canada.

LONG RANGE AT SEA.—Few people are able to calculate the distance at which objects may be seen at sea; but it is not a difficult matter when their respective elevation of the eye of the observer are known. For instance, an object five feet high may be seen 2¼ miles (geographical;) 50 feet high, 8 miles; 100 feet high, 11½ miles; 200 feet high, 16¼ miles; 500 feet high, 25½ miles; 1,000 feet high, 36¼ miles away. As an example, a tower 120 feet high will be visible, to an observer whose eye is elevated 15 feet above the water, 17 nautical miles.

The Hall Duplex Plunger Pump.

The accompanying section illustrates the interior arrangement, construction and operation of the steam valves of the Hall Duplex Plunger Pump. They are a combination of simplicity, durability and certainty of action. The engine of one division acts to operate the steam valve of the other, and vice versa. In the above view, the valve (which is a plain flat slide-valve) stands at the left of its stroke, admitting steam to the right of the main piston, moving it to the left. When the piston nearly reaches the end of its stroke and passes by the port *A* (at the top of the cylinder,) a small portion of the pressure, which



HALL DUPLEX PLUNGER PUMP—Sectional View of Steam Cylinder and Chest.

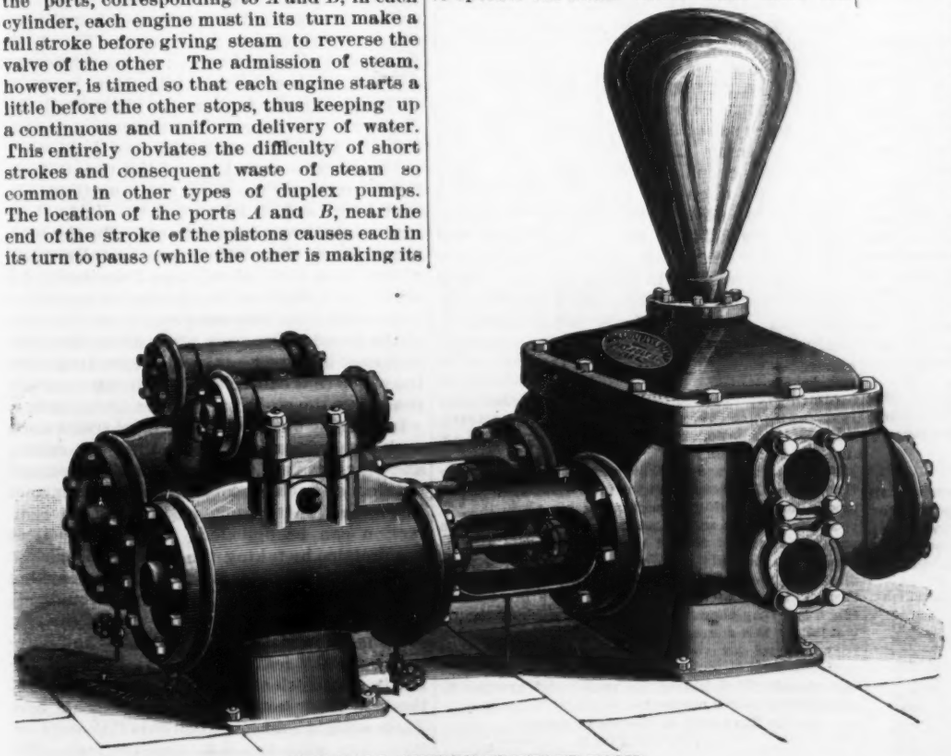
has been moving the main piston, passes through this port across to, and shifts the valve of the other engine which then makes its stroke, and in a like manner admits steam across to reverse the valve of the former. It will thus be seen that by proper location of the ports, corresponding to *A* and *B*, in each cylinder, each engine must in its turn make a full stroke before giving steam to reverse the valve of the other The admission of steam, however, is timed so that each engine starts a little before the other stops, thus keeping up a continuous and uniform delivery of water. This entirely obviates the difficulty of short strokes and consequent waste of steam so common in other types of duplex pumps. The location of the ports *A* and *B*, near the end of the stroke of the pistons causes each in its turn to pause (while the other is making its stroke) for a length of time sufficient to allow the seating of the pump valves by gravity instead of by the action of the return currents, this being the only perfect way of moving water under heavy pressure, without noisy, imperfect and injurious action.

These pumps have been for some time in successful operation, and their peculiar excellence has been proven.

They have the following important features which must commend them to all persons using pumping machinery: Simplicity. Fewness of parts. They make no short strokes. They are noiseless in operation. They are positive under any pressure. They occupy less space than any pump of like capacity. They have no dead point or center, as the valves on either engine are constantly open.

They will start at any point of the stroke, and exhaust the water produced by the condensation of steam. They are without a single working joint, so they can be run at high speed with the smallest amount of friction There are no mechanical devices whatever to operate the steam valve. Thus there can be no derangement of valve gear from sudden starting, high speed, or from continued rough usage.

The valve mechanism of each engine consists of but two moving pieces,—a common D slide valve, and a small steam piston by which the slide valve is moved. As this piston is sure to get a direct pressure of steam at the proper time to move it, it is absolutely positive and as certain of action as the main piston of any engine.



THE HALL DUPLEX PLUNGER PUMP.

The working parts are enclosed and beyond the control of vicious or meddlesome persons as well as protected from accidental injury. The general arrangement and construction of these pumps allow of a high rate of speed, without noise, shock, or jar, thus increasing their capacity over any other style of steam pump. The cushion of the pistons being so effective that the entire load against which the pump is working may be suddenly thrown off, with full head of steam on, without any danger of the pistons striking the cylinder heads, or in any other way in injuring the pump.

The water ends, either piston or plunger pattern, are of the latest and most approved design. The valves are also of simple and approved form, being plain flat disks of composition, or hard or soft rubber, working with a low lift upon a central stem. All stuffing boxes, lining in water cylinders, valve seats and stems are of composition. Material and workmanship throughout are of the very best that can be obtained. All parts are made to gauge and are interchangeable. Every machine is thoroughly tested, and sold under a full guarantee to perform the duty required with ease and certainty of action.—ADV.

Domestic Refuse and its Removal.

The gross average quantity of road refuse in the Metropolis is said to be 361 cubic yards per mile of way for the year. Taking the street and house refuse in the Metropolis for one year, while there are 361 cubic yards from the streets, and nearly 100 cubic yards of deposits in catch-pits and sewers, the dust and house refuse amounts to about 287 cubic yards per mile, making a total of 746 cubic yards. This calculation gives per mile per day 2 cubic yards of total slop, deposit, and house refuse. These figures show the magnitude of the work of removal. The dust or house refuse is three-fourths as much as the slop from the street. There is no doubt the parish authorities, vestries, and district boards are puzzled with this constant and increasing accumulation of mud and refuse. In spite of the whole army of sweepers and dustmen, the work appears to be constantly in arrear. The authorities are, however, not wholly to blame. The law explicitly directs, as far as the Metropolis goes that if any person, not being the occupier of the house within the district, removes or obstructs the local authority or contractor in removing house refuse, he will for each offence be liable to a penalty not exceeding £5; while if the occupier of a house removes or obstructs the local authority in removing any refuse except where it is produced on his own premises, and is removed for his own use as manure, he will incur a penalty of £2. Persons making default where notice of removal has been given, are also liable to a penalty. In some of the larger parishes the labor of collection is extensively heavy, and is becoming heavier every year. Confining our attention to the domestic refuse, the question of removal is a very important one in many of the suburban streets in the metropolis. Whole streets of houses, the ashbins of which have not been emptied for months, are to be seen in almost any district, partly owing to the neglect of householders but chiefly because the contractors find the work greater than they can undertake. Till the public are taught to understand the purifying action of fire, and the value of much of what they now consign to the waste heap as fuel, it will be vain to expect these offensive receptacles to be used for their legitimate purpose of ash boxes. Some conduit or channel of conveyance from the receptacle to the street is necessary, and it appears that a kind of subway in the basement is one of the simplest and most practicable methods.—*Building News.*

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CLUBBING ARRANGEMENTS.

1886.

The "subscription season" for the most popular American Magazines is close at hand, and inquiries as to our proposed clubbing arrangements are being made. We beg leave to announce, therefore, that on and after JANUARY 1, 1886, the subscription price of ENGINEERING NEWS will be **$5.00** per year; until that date the price and clubbing rates with other publications will remain as given below.

We are now planning such improvements in ENGINEERING NEWS, and negotiating for special work to be done during the coming year, as will cost double any possible increase of income from subscriptions; the long notice of change which we here give enables nearly, if not all, present subscribers to renew at present rates. We intend eventually to publish a class journal which will acknowledge no superior in the world, and we feel so confident of the support of our present patrons that we have no hesitation in venturing on the greatly increased expense necessary to carry out our programme.

If an English engineering journal, carrying fifty pages of advertisements and twenty four of reading matter sells for $10, why may not an American journal of equal merit sell for at least half as much.

In order to accommodate such of our subscribers as may wish to subscribe for other periodicals, we offer he following terms until January 1, 1886: We will send to any address ENGINEERING NEWS at regular subscription price, **$4.00** and the following at the additional prices given:

	Net. Price.	Reg. Price.
Atlantic Monthly	$3.25	$4.00
Century Magazine	3.55	4.00
Harper's Magazine	3.25	4.00
Harper's Weekly	3.25	4.00
Harper's Bazar	3.25	4.00
Harper's Young People (weekly)	1.65	2.00
Popular Science Monthly	4.25	5.00
St. Nicholas Magazine	2.55	3.00
North American Review	4.10	5.00
Cassell's Magazine of Art.....m	3.00	3.50
Cassell's Family Magazine.....m	1.25	1.50

The Century Magazine commences its year with th November Number; Harper's Magazine commence with the December Number. Subscribers should renew these Magazines in October and November.

Subscribers to other publications clubbed with ENGINEERING NEWS, must notify those "other publications direct, of change of address during the year. After we have transmitted for the year's subscription and had the subscriber's name and address properly entered on he clubbing lists, our connection with the transaction *ceases entirely*. Our margin of five cents on each subscriber does not allow for much extra expense in time and postage and stationary.

SECRETARY of War Endicott has just decided that the Corps of Engineers, U. S. A., is essentially a staff corps and that therefore its officers are not entitled to command when a line officer of any grade is present. This point has been raised by the absence of the commandant of the Military Academy on leave, and an engineer officer in the academy, the next officer in rank, claiming the command.

NOTWITHSTANDING the contrary opinions of fishermen experts, as set forth in newspaper interviews, the latest inspection of the shattered remains of Flood Rock show that the explosion of last Saturday was completely successful. The Negro Head, about which there were so many doubts expressed, is found by the government diver to be filled with fissures, and this rock, along with the other parts of the late reef, is slowly settling out of sight; in fact, very little of the original Flood Rock and its artificial island is now to be seen at all.

In our general article on this subject, we omitted to note that in the excavation of miles of galleries, extending over a period of ten years, and in the manufacture, transportation, loading and firing of a volume of powder enormously in excess of any previous experience, not a single human life was lost, and no accident of any kind occurred. This can only be due to excellent organization and exceeding care on the part of those in charge, and Lieut. Derby, and the gentlemen connected with him, are to be congratulated on this unusual departure from the experience on other great public works. It is a fact, too little appreciated, that almost without exception, every important engineering structure or operation is sprinkled with the blood of workmen sacrificed.

OUR excellent contemporary *The Sanitary Engineer*, in its last issue, contains a copy of a circular letter from a citizens committee of Grand Rapids, Mich., and an answer to the same from a well known civil engineer.

The worthy committee is constituted "to secure some scientific and practical" information concerning the disposal of sewage, its utilization, chemical treatment, etc.; they want advice upon the subject with special reference to a State institution and "desire to ransack the field of knowledge;" they will pay for any acceptable device, "if adopted."

The reply referred to covers the case so well that we reprint it for the benefit of other corporations and individuals who resort to similar methods in begging their engineering advice:—

"DEAR SIR: Your circular is received. Believing from the tone of your circular that you are earnestly desiring information, but are going at it wrongly, I am impelled to address you.

If your family were sick, would you send a similar circular to the doctors and manufacturers of patent medicines, or would you seek a reliable physician? If you were troubled with some legal difficulty, would you put out a drag-net for all the law books and various views upon the subject? Would it not be better to go directly to the lunatic asylum than wait to be driven there by trying to solve either of these problems in that way? Why, then, in a question of engineering, do you follow this course? It would take years of study for you to get any true knowledge of the subject. Why not, therefore, engage some competent engineer who has already fitted himself by study and practice to advise upon such a matter?

I write this freely, as it is *not* in my line.

Yours very truly, ——."

In the circular thus answered, the data furnished upon which to figure out a solution is summed up in the simple statement that it is a "State Soldiers Home," that the ordinary pipe sewer is impracticable and that "about 400 inmates are expected." This meagre information, upon which valuable professional advice is expected, agrees well with the simplicity of heart and ignorance of men which supposes that all engineers are philanthropists, who devote a life time to deep study and hard work simply for the general benefit of "citizens committees" *et al.* Strange as it may seem, these same gentlemen never credit their doctors and their legal advisers with a similar overplus of the milk of human kindness, and it is about time that they learned the fact that all professional advice worth having is worth paying for.

Railway Time Charts.

We have been called upon by some of our readers to illustrate and describe the method of graphically representing the running of railway trains by means of a properly divided board, strings and pins, and would answer as follows:

It is generally supposed that without this "time-chart," so called, no intricate time table on a trunk line could be made up. This is a popular error, and except as a check and for special purposes, the board is little used at all on many of the most important railway lines in the country. In the Superintendent's office of the New York Central and Hudson River railroad, with its 993 miles of track, for instance, such a board is to be found, but judging from its present appearance, the ancient threads traversing its surface are more useful as a playground and resting place for flies than as an indispensible adjunct in the manufacture of the numerous time-tables required on this popular line.

Railway time-tables are the work of experts, men thoroughly acquainted with the distances between stations, gradients and local demands for traffic on the line. They are the results of calculation based upon this knowledge, and to the men intrusted with this work the graphic assistant is of little use.

But for the benefit of those who are not experts and for general information we will describe the chart and its working; it is really too simple to require an illustration. The basis is usually a huge board painted white and fixed upon the office wall. This board is divided vertically for time and horizontally for distances. The time divisions commence on the left with 12 o'clock midnight, and bold vertical lines mark each hour of the twenty-four; lighter vertical lines mark the ten minutes in each hour, and still lighter lines divide these again into two-minute spaces. On the horizontal lines the stations on the railway are plotted to a scale of miles and decimals of a mile, these stations being spaced according to the distances between them, down the ends of the board. The scale upon which the chart is plotted is purely optional, depending upon the space that can be allotted to this purpose; the larger the scale, the plainer the diagram.

In figuring out the movement of trains upon such a chart, threads, often of varying colors, and pins, are used. The names of stations are painted at each end of the same horizontal line so that the passage of trains in each direction can be depicted. We will illustrate the practice by taking the running of certain trains on the Hudson River R. R.; remarking that as the principle is the same throughout; the number of trains simply makes the diagram more intricate. We will take the "Saratoga Special" leaving the Grand Central Depot in New York at 3.30 P. M.; supposing that the first upper horizontal line represents New York, a pin would be put on this line at its intersection with the 3.30 time-vertical. The first stop is made at Cold Spring, fifty-one miles distant, and the train is due there at 4.46 P. M.; to show this on the chart a thread attached to the New York pin would be stretched to another placed at the intersection of the Cold Spring horizontal and the 4.46 vertical line. If the train should stop at this station five minutes, the thread would be run horizontally to the 4.51 vertical before starting for the next station, which in this case is Fishkill. The thread is run in this manner to Troy, one hundred and forty-seven miles distant, and it

would stop on the 7.45 P. M. time-vertical, having a general diagonal course from left to right down the board.

Running this same train in the opposite direction, we would start our thread at 9.45 A. M. on the Troy horizontal and run up the board to its arrival at New York at 2.12 P. M., stopping at all designated stations as before. These trains evidently do not pass each other, as the down train arrives before the train bound North leaves the depot.

In this manner all trains leaving from and arriving at a terminal of the road can be shown on the chart; and on tne same chart all freight trains, with their stops on sidings, etc., could be also represented. But, as can readily be seen, such a practice in the case of a trunk line with many coming and going trains and a heavy traffic, would be productive of a net work of threads that would be so intricate as to destroy their practical value. In practice a double-track road may have a chart for each track so that diagonals in one direction only will appear on each; and, as a means of better adjusting the speed between various points, and the consequent angle made by the diagonal, the grades and curves of the road may be shown at the end verticals on the board where they can be readily referred to. On roads of such length and traffic that all trains can be represented on the one train-chart, red threads usually denote passenger trains; blue threads, freight trains and black threads are used for Saturday or other special trains.

On a railroad of comparatively limited traffic, we doubt not that this train-chart would be a useful agent in adjusting the rate and passage of trains; provided always that curvature and gradients, with other local conditions, be duly considered. It is hardly necessary to remark that setting a thread at an angle between two stations that represents a speed of 50 miles per hour, does not assist a heavy train up a steep grade. The road must be studied in all its bearings, the speed of trains calculated and the traffic demands figured; and when this is done, the results may or may not be shown graphically on a time-chart.

The Explosion at Flood Rock.

On Saturday, Oct 10th, at 11.14 A. M., seventy-fifth meridian time, the mine under Flood Rock was fired, and the work of ten years of rock excavation, the pillars and the massive roof left over the miles of subterranean galleries, were shattered preparatory to the final removal of this greatest obstruction to navigation at Hell Gate.

Although the volume of explosive here used exceeded six-fold the greatest charge ever previously fired in the world, the work of the engineers was so well done and the precautionary measures of General Newton so well taken, that no accident or delay of any kind occurred. As well as can be at this time be ascertained, the result has been thoroughly satisfactory, but the efficiency of the blast can only be tested by careful soundings, showing the change in the surface of the rock and by the dredging which is now to follow. The purpose of the engineers was not to blow all this rocky mass skyward, nor to force it down into the lowermost depths, as many of the lookers-on supposed, but to shatter it into fragments of such size that they can be lifted by the powerful dredges used at the old Hallet's Point work. It is possible that, at the higher points, some of the rock may have to be again broken before removal, but this is a minor labor, and can be easily accomplished by methods similar to those used on the isolated rocks.

Judging from the surface effect, every portion of the mine was exploded, and with this unpredented volume of powder fired the pillars and the roof *must* be broken up. Mere word painting will give but a meagre idea of the spectacular effect of the explosion; for ourselves, we can only compare it to an ice-berg with many sharp, glittering pinnacles suddenly rising out of the dark waters of the East River, and then slowly settling down again. As to mass, nine acres were covered, and the highest peaks, we should say, rose about 250 feet above the surface. One or two secondary movements of the water showed where several of the outlying galleries were a little slow in exploding, and the water's surface tinged a golden yellow from the dense volume of chlorine gas escaping made a fitting ending to this grand engineering event.

The physical effect was far reaching; the shock was very perceptible over the entire rock formation of Manhattan Island, and was comparable only to an earthquake tremor. The tidal wave expected did not amount to much and practically expended its force on the Astoria shore only; a few windows were broken in houses on this nearest land, and some few weak patches of ceiling fell, but otherwise no harm was done. The sound that followed the passage of that tiny electric spark, let loose by the finger of the 12-year old daughter of General Newton, was a deep, far-away rumble and a thud that was rather felt than heard; it was impressive from its subdued energy, and to the engineer conveyed an idea of the great resistance that this enormous stored power had to overcome. What 280,000 pounds of dynamite and rackarock would do when suddenly let loose, could only be previously surmised by the wisest among the experts present, for the volume was far beyond precedent; hence common caution and common sense kept the spectators at a very respectful distance from the immediate scene of action. But the result showed that in this case the danger-line hardly extended beyond 200 yards from the limits of the reef.

The work of the miners with their drills and their cartridges of dynamite is now practically done, and the dredgers will come into play. The picking up of the rocky fragments and their removal to other points will be the work of two or three years; this work will be done by contract, and the estimated cost is about $500,000.

When all the debris is cleared from the site of Flood Rock, down to the 26-feet contour plane, the channel at Hell Gate will be practically doubled in width, being then 1,200 feet wide as compared with the 600 feet of to-day. With 26 feet of water at mean low side, ocean steamers can enter the East River by this route as far as the channel is concerned, and the terrors of Hell Gate will be a tradition of the past, to be forgotten or only referred to along with the history of another time and people.

In our issue of September 12th, we described and illustrated the location of Flood Rock and the excavation of the material; in addition to what we then said and at the risk of some repetition we will now speak of the explosives and the manner of using them.

As previously mentioned, the pillars left to support the roof, and the pillars themselves, had drilled in them 13,286 holes, each hole averaging about 9 feet in depth. In the roof the holes were spaced about 4 feet apart, and in this shell the great mass of the explosive was stored; the pillars were only charged with powder above the 30-foot contour plane, and in holes about 5 feet apart; consequently a portion of these still remain intact, accounting in a measure for the comparatively slight settlement of the broken rock as compared with the results at Hallet's Point. The system of blasting at Flood Rock differed considerably from that previously adopted at the Point. In the operations previous to 1876 the effort was made to hollow out as much of the rock as was possible before breaking the shell; and to excavate sufficiently deep below the 26-foot contour to provide a space to store the rock falling from the roof shattered by the blast. Experience at that point proved, however, that it was more economical to remove the rock by dredging after it was broken into masses less than fifteen feet in greatest dimension than to attempt to break it out by the more costly machine drill and small charges. This change in system accounts for the fact that while rock and timbers were thrown high into the air at the Hallett's Point explosion, no such surface demonstration followed the firing of a greater volume of explosive at the Flood Rock. In the first case the rock shell was comparatively thin, as the roof of the galleries followed as closely as possible the contour of the surface of the rock; the rock in several points on the Hallet's Reef was little more than 4 feet thick, and the pillars were heavily charged so that they might be almost entirely removed and permit the broken rock to settle to the bottom. At Flood Rock, on the contrary, the roof was nowhere less than 15 feet thick, and was usually nearer 20 feet thick, in some parts much exceeding this. When it is considered that the powder has to exert its force in breaking over 200,000 cubic yards of rock left standing, or in round numbers 400,000 tons, and that it would have to lift this mass with the addition of nearly 200,000 tons of water, averaging the depth at only 15 feet over the area of the rock, there is little wonder that the surface rock should be simply shattered instead of being cast afar in small fragments as the many seemed to expect. General Newton

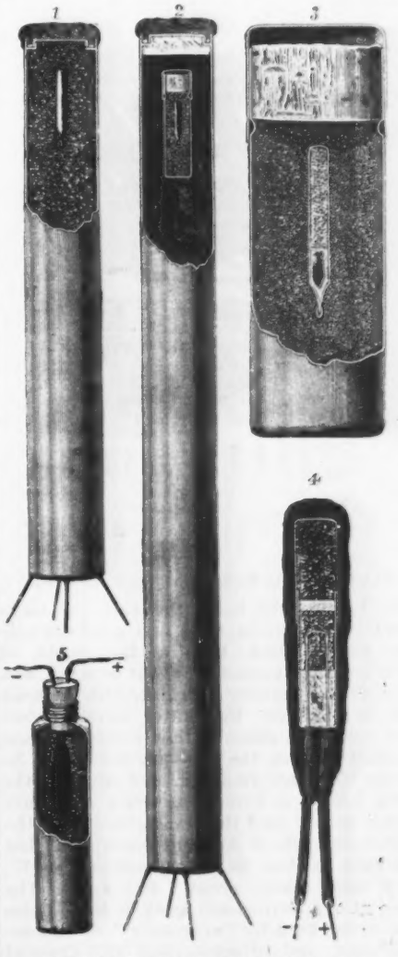

PLATE I.—THE CARTRIDGES AND EXPLODERS.

wisely decided that it was better, if it even now should be necessary, to reduce the larger fragments by further blasting than to risk the destruction to property and life that would certainly have followed a too heavy charge and the hailstorm of small rock.

To continue our story of the loading of the holes, we will next refer to Plate I, showing

the cartridges used and the exploders, (for which excellent illustration and also Plate II, we are indebted to the *Scientific American*). Fig. 2, Plate I, shows the rackarock cartridge, which is 24 inches long and 2½ inches in diameter. This case of thin rolled copper is tinned on the inside, and the side and bottom are soldered together; it holds six pounds of rackarock and before being closed had inserted into it a small copper case, Fig. 3, containing about one ounce of dynamite No. 1, and in this case is a still smaller copper tube containing 30 grains of fulminate of mercury. The fulminate tube is sealed by being pinched shut and was then dipped in melted solder; the dynamite exploder has a cork stopper, placed in the open end of the tube which is then dipped in glue and a copper cap is put over it as shown; the main cartridge case is closed by having a cap soldered into it by a fusible alloy melted by a steam-heated soldering iron. Each main cartridge was dipped in oil and pitch and then rolled in sand to protect it from corrosion. The four projecting wires shown in the illustration serve to center the cartridge in the hole and help to hold it in place.

Fig. 1, in the same plate, shows the dynamite cartridge, 15-inches long by 2½ inches in diameter; it contains 3 pounds of dynamite No. 1 and an ordinary 30-grain fulminate exploder. (In this figure the four wires are shown at the wrong end, they were really attached to the head of the case, projecting backward).

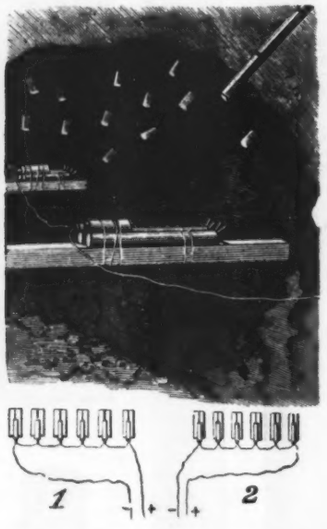

PLATE II.—THE EXPLODING CHARGES IN PLACE.

In loading the holes, the cases of rackarock were put in head first until the hole was nearly filled, then at the mouth of each hole, and projecting about 6-inches, was placed the dynamite cartridge, with the head also in the hole; this latter cartridge was kept solidly in place by thin wooden wedges inserted between the case and the rock. So far no wires are required, and with all the holes loaded a looker-on would only have seen a gallery roof thickly studded with the projecting ends of dynamite cartridges, but not quite as close as they appear in Plate II; they were really about 4 feet apart. The mass of explosive stored away in these holes was to be fired by "sympathy" or concussion only, and to accomplish this General Newton devised the ingenious method shown in Plate II. At intervals along each gallery 3 by 5-inch timbers were fixed in such a manner that no loaded hole was more than 12½ feet from the mine exploder attached to these timbers. Tied side by side on each of these sticks were two of the rackarock cases, previously described, and each containing 5-pounds of dynamite No. 1, and upon these two cartridges was tied the mine exploder shown in Plate I, Figs. 4, and 5. This exploder is a copper-case, 7½ by 1¼ inches, containing somewhat less than half a pound of dynamite No. 1,; inclosed within this tube is the fuse Fig. 4; this latter is shown about full size in the figure. It is a tube of copper containing 30 grains of fulminate, and sliding in this tube is another with one end closed by sulphur, which firmly holds the battery wires, and more fulminate surrounding the platinum bridge which connects the conducting wires. This fuse when completed was entirely covered with gutta-percha. The conducting wires pass through a cork in the dynamite case as shown in Fig. 5.

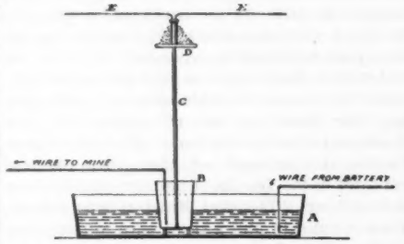

PLATE III. PRINCIPLE OF THE FIRING APPARATUS.

These mine exploders were arranged in 24 independent groups, as shown at 1 and 2, Plate II, there being 25 fuses in each group; the positive and negative wires of each group passed to the surface of the rock at the shaft and were there connected with the firing apparatus. When the 600 fuses explode the 6,000 pounds of dynamite on which they rest, the dynamite cartridges projecting from the holes and the rackarock back of them explode from the concussion conveyed through the water which filled the galleries and practically acted as tamping. By this device, previously tested by elaborate experiment, the cobweb of separate wires leading to each of the nearly 14,000 holes was avoided, if indeed wiring on so extensive a scale had been at all practicable.

Plate III, illustrates the principle of the apparatus actually used in connecting the electrical circuits, and firing the mine. This simple, but very effective device was, we understand, suggested by Gen. Newton, but Lieut. Derby deserves all the credit for developing the idea.

Let us suppose that all the positive or + ends of the mine circuits are inserted in a shallow iron vessel *A*, filled with mercury, and that all the negative or—ends of these same circuits are placed in a thin glass vessel *B*, in such a manner, that while the ends of the wires are below the surface of the mercury, they are kept from contact by being inside the glass vessel, placed in the mercury on an iron ring, as shown. Standing upright in this glass *B*, is an iron rod *C*, one quarter inch in diameter, supported vertically by a wooden frame not shown; on top of this rod is a horizontal plate, *D*, with an exploder upon it, and loose dynamite heaped about the exploder. This was virtually the outfit used last Saturday, and its action was as follows: When the tiny spark passed under the water from the Astoria shore, it exploded the cap standing on the plate; this drove the rod downward, and shattered the glass *B*; the positive and negative poles of the circuit wires were connected by the mercury, the full battery current was brought into play, and the mine exploded. We have very excellent authority for saying that the automatic arrangement spoken of by many of the daily and other papers of this city, was not employed at all. In Plate III, the circuit wires actually passed into secondary vessels of mercury, connected with the vessel *A*, by copper bridges. The battery used had in all, sixty cells, and each cell contained seven plates, or four carbon plates, 6x9x¼ inch, and three zinc plates, 6x9x⅛ inch. The internal resistance of each cell was exceedingly small, it being only 0.001 oh m

The total mass of explosives used, as near as we can learn, was 240,000 pounds of the rackarock, and a little over 40,000 pounds of dynamite No. 1. In our previous article, we stated that the rackarock, a compound of chlorate of potash and dinitro-benzole, had 95 per cent. of the effective power of dynamite No. 1. This was an error; the guarantee of the manufacturers was 95 per cent., but the average of twenty-five tests made by Gen. Abbott, the record of which we have seen, shows nearly 9 per cent. *in excess* of dynamite No 1. while six of the twenty-five tests ran above 109. and one reached 115, as compared with dynamite No. 1 taken at 100.

Railroads in Japan and China.

The conservative influence in the Chinese government that has heretofore trammeled the introduction of railways in that country, seems at last to be losing its force, and there is now some well-grounded prospect of the commencement of an era of railroad building among the exclusi e Celestials.

Japan has already passed through this tentative period, and their first line was opened to traffic in 1872. A correspondent of the *Manchester Guardian*, England, has lately been making a study of the Japanese railway systems, and from his letter we gather the following record of progress:

After much opposition from the Conservative party in the empire, the first railroad was finished in 1872, from Yokohama to Kioto; this line was 18 miles long and was double-tracked in 1880. The next line, from Hiogo to Osaca, was 22 miles long and was opened in 1874, and was extended in 1876 27 miles northward to Kioto, and, in 1879, 11¼ miles further north to Oten. This last extension connected the important inland waters with the sea, and a line of steamers now ply on the Lake Biwa, which is about as large as Lake Geneva. Another line, commenced in 1880, now runs 49 miles from Suruga to Ogaki and connects the northern end of Lake Biwa with the Japan Sea at Wakasa Bay.

The Japan Railway Company, organized with a total capital of 26,000,000 *yen*, is now engaged in pushing the system still further, and at the present time, 314 miles of railway are in actual operation, and nearly 800 miles are in course of construction. In December, 1883, the government issued a loan of 20,000,000 *yen* for the special purpose of building the Nakasendo R. R., a trunk midland line 213 miles long intended to connect the two groups of railways ramifying towards the seaboard.

All of these railways are built, or located, to a 3 feet 6 inch gauge, with the single exception of a short local line between Osaca and Saka, which has a gauge of only 2 feet 9 inches. The cost of the earlier lines has been much too high; the Tokio and Yokohama section, for instance, foots up at £34,000, or about $170,000, per mile. This cost, in a country where little compensation is paid for land taken, shows extravagant and wasteful management. At present, the companies depend on passenger traffic for their revenue; there being little freight to move, but travelling is popular with the natives. The gross receipts, however, on the costly Tokio-Yokohama section, amounted in 1884 to 17 per cent. on the capital outlay.

In building these roads, part of the iron work, such as girders, was made in Japan; the locomotives come mainly from Germany, and the rails and rolling stock from England. Latterly the engineering work is mainly done by Japanese, educated in the Engineering College of Tokio, and all the employes of the Japan Railway Co. are natives. Serious accidents have been very rare and willful damage to the railroad property is almost unknown.

In China, the present status of railway af-

fairs is outlined by the *London Times* as follows: In 1880 Lio Ming Chwan memorialized the throne in favor of the construction of railroads, suggesting four trunk lines that should properly be first built. While a commission was appointed to consider the memorial little real progress has been made in that direction. But China knows fairly well what railroads cost in other countries, and she knows that the first lines she builds will cost much more than the average. The system of short loans of that country is inapplicable to railroad building, but she is rapidly gaining experience in financial matters and her credit is good, and before long she will be reconciled to borrowing for longer periods.

China can easily find responsible parties who will build and equip 1,000 miles of railroad for her; and the fact that she has not yet made such contract is a proof that she either does not want the railroads or will not pay the price demanded. Ten years ago the first reason was the true one; to-day her delay is occasioned by the search after better bargains; she wants to build but hopes to find a cheaper way of doing it than is yet presented by the outside barbarian.

PERSONAL.

STEPHEN E. BABCOCK. of Troy, has received the unanimous appointment as engineer of the proposed system of water-works for Little Falls, N. Y.

G. M. BEACH has been appointed General Manager of the Cleveland, Columbus, Cincinnati and Indianapolis Railroad, vice E. B. Thomas, resigned to accept the general management of the Richmond and Danville Road.

BENJAMIN H. GREEN was, on October 3rd, appointed surveyor general of Montana. Mr. Green is a native of Georgia, and for many years past has been living in Louisiana. He was the engineer of the New Orleans Pacific railway, now part of the Gould system. For a year or two he was railroad building in Texas, and he is now a resident of Mississippi.

A SUIT has been brought in the Supreme Court in Brooklyn, by A. H. Van Sinderen, a lawyer, to recover $12,000 from William H. Cooper, a son of Admiral Cooper, of the United States Navy. In July Van Sinderen went to Cooper's office, at No. 62 William street, where he carries on his business as an engineer, chemist and metallurist, under the firm name of Cooper & Sands, and Cooper stated that the United States Fish Commissioners had awarded him a contract for pumping engines, to cost $36,000, which he had engaged of the Davidson Steam Pump Company for $30,000. He had to deposit $24,000 with the Fish Commissioner, and offered Van Sinderen $1,800 as his share of the profits for the loan of $12,000. Documents setting forth the conditions of the contract were produced by Cooper, and appeared to be genuine. Trusting in these and Cooper's friendship and statements, Van Sinderen advanced him $12,000, and received in return the contract as security and a promissory note for $13,800, payable in two months. A few days later Cooper showed what purported to be a receipt for $24,000 deposited with the Fish Commission, and on September 2d, he paid over $300 as part of the profits. On September 30th, the plaintiff received a note from Cooper setting forth that the papers he held were of no value; that he (Cooper) had thought it was all right, but had been swindled by a man named Stone. He wrote that he was going to a port where money was due him and would return in six months and pay up, adding that the agony of the affair had nearly driven him crazy.

Van Sinderen found on sending to Washington that the alleged contract was a fraud. Cooper formerly lived in the Clarendon Hotel in Brooklyn, but left there on September 25th. It is asserted that he bet heavily on the Coney Island races last summer, and that other friends have been cheated by him.—*N. Y. Tribune.*

TRACK.*

BY W. B. PARSONS, JR., C. E.
ROADMASTER SUSQUEHANNA DIVISION ERIE R. R.

(*Concluded from page 237*).

A flanging car in a machine to mechanically remove snow from the inside of both rails, of which there are several different designs, but the accompanying diagrams† show an improved type in detail, the standard of N. Y. W. S. & B. R. R. Fig. 118 gives a side elevation of the car and flanger, while Fig. 119 is an end elevation with additional details; in Fig. 120 the flanger is seen in inverted plan. The apparatus can be attached to a box-car or even to a flat car housed over to protect the attendants from the weather. On approaching frogs, crossings, etc., the flanger must be raised, and the pressure of such obstructions and their subsequent passage can be denoted by a system of signals from the engine which hauls the car. But even if the flanger should strike such an obstacle, damage will not result unless running at a high rate of speed as the blow will simply throw the flanger up. The car as designed intends the hoisting to be done by block and fall as indicated in Fig. 118. Much better than this is to use compressed air from the air-break apparatus. The method of attaching the cylinder is shown in Fig. 118, being hung on a pin at the top to the roof timbers, so as to revolve as the lever is raised. The best position for the cylinder is a mean inclination between the normals to the lever when down or raised. Fig. 121 gives full details of the cylinder which will be seen, is single headed as air on one side only is needed. The method of connecting the supply and exhaust and working the apparatus by the two stop-cocks, together with the other features, are clearly shown in the cuts. Such a car is a great saving in labor and an incomparable assistance to the transportation department.

Every officer of Maintenance of Way should at all times endeavor to inspire each foreman with an *esprit de corps* and institute between the different men a friendly rivalry, to which end will be found conducive a well regulated system of rewards and the practice of periodically publishing the amount of work performed on the various sections, as for instance, ties replaced, taking care however that the quality of the work is not slighted for the sake of speed. First establish an air of neatness about everything. Whatever work the men are at, make them do it in a cleanly manner, which costs little and kindles a feeling of pride. Make the men begin with their tool houses, insist that they shall be kept clean and orderly, and that every tool and supply shall have its proper place, pegs to hang shovels on, racks to support the mauls, picks and tools, a definite corner for the bars, the extra bolts and spikes in kegs and not loose so that in the morning when starting out fifteen minutes need not be lost looking for some special article.

Outside the house there should be a platform divided into three partitions for car scraps, wrought and cast track scrap, so that when any particular kind is to be shipped it is already sorted. Extra fence material, crossing plank, splice bars and such supplies, should be laid up in neat piles. Be very particular with the men as to the policing of their sections. Regular skids should be made at stated intervals, to hold the extra rails, and then rails should be placed on the skids parallel to the main track, and not simply

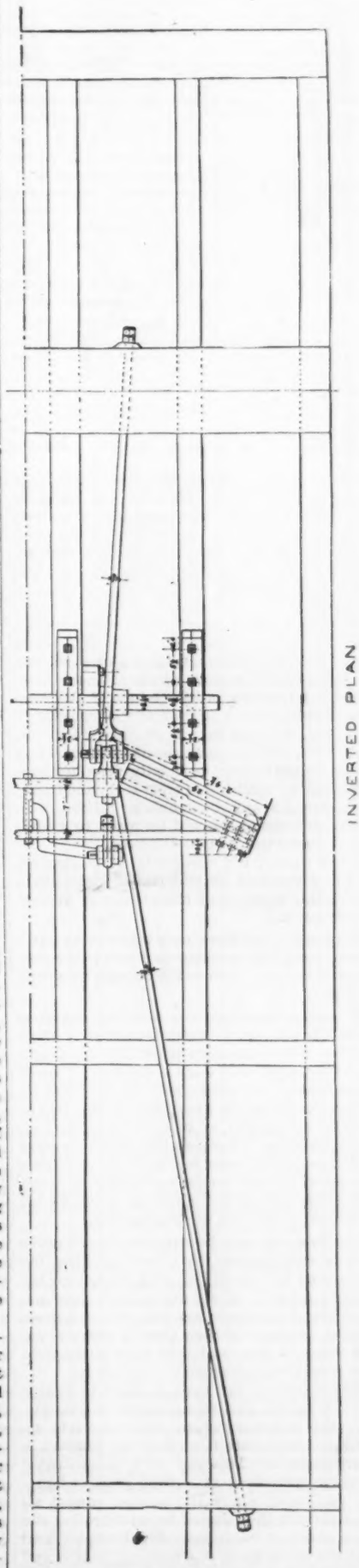

FIG. 120.—THE FLANGER IN INVERTED PLAN.

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†For Figs. 118 and 119, see pages 141 and 183.

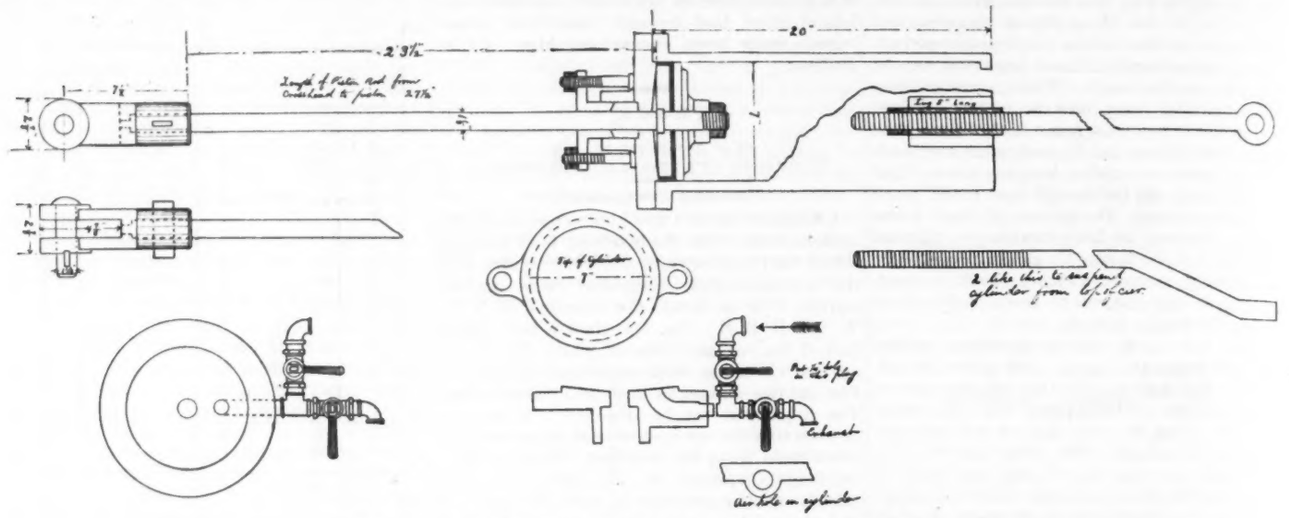

FIG. 121—. FLANGING CAR. DETAILS OF HOISTING ATTACHMENT.

thrown down. Whenever draw-bars, car doors or scrap of any kind is seen lying by the track, it should be at once picked up, and either placed in its proper pile at the tool-house, or shipped away according to instructions. Then on regular occasions, not less than once a month, a systematic cleaning of the section should be made, picking up bolts, spikes, and other small pieces which are not seen, as the men run their hand car to and fro. The value of scraps lying along the road is considerable, and is worth attention; besides it impresses on the minds of the men their responsibility of trust of the company's property, and that they must take care of it, The track and grounds around stations and yards should be kept especially clean, for here it is that the road-bed is most seen, and therefore should alway be in holiday attire.

Every foreman should be made to understand the motto, "Do to-day."

Work should not needlessly be postponed, and no job should be undertaken unless with reasonable prospect of completing it without interruption.

Foremen should not only make every day's work count, but endeavor to finish it in a substantial manner, so as not to require returning to it later.

It seems tempting for him, no doubt, to tamp slightly, or to hurry the dressing off in order to work over more track than his neighbors; but a job well done is finished; it needs no tinkering afterwards; and although it takes a little longer in the first place, do not let the men be discharged, as it will pay in the end.

The ability of a foreman to exercise a proper and firm control over his men, to distribute the force to best advantage while at work, should be considered quite as much as his judgment or own his working abilities.

The first can only be discovered, unless the lack is very flagrant, by close watching, but the second can readily be seen every time the gang is passed. The foreman who does not understand will have his men all in a heap, so that they are in each other's way, and unless stopped, men will take such position as best gives them a chance to "old soldier."

Men should be far enough apart to be able to work easily, and so arranged, if possible, that each man has but one bit of work to accomplish by himself, so that the laggard is easily detected. This can be best illustrated by such operations as cutting grass or flanging out snow, where if the men cannot all work abreast, they should be set to trail at the space of one or two telegraph poles apart, and then the whole force move ahead bodily, and not allowed to walk around each other to get a fresh spot. A poor foreman will let his men follow close upon each other's heels, so that they really work over the same ground, each man skimming a little deeper than his leader.

For the purpose of estimating or judging the capabilties of a gang every officer should acquaint himself with the amount of work one man in a well organized gang can accomplish in a day of ten hours. The following table gives an approximate value of the day's labor for various important items under ordinary average conditions, the material in each case supposed to be conveniently distributed beforehand as in actual practice.

Cinders, loading	25 yards.
Fence, building—board	80 feet.
" " —wire	195 "
Gravel, loading	121.15 yards.
Grubbing road-bed	300 to 900 ft.
Mowing right of way	1 acre.
Rails, replacing (no trains)	200 feet.
Snow, flanging	2,000 ft. track.
Ties making inc. felling, sawing hewing	20
" loading from road-bed level	200
" " " platform	300
" replacing	14
" tamping, with bars	40
" " " shovels	120
Track, laying	300 feet
" and surfacing	100 "
" raising ⅝ in. shovel tamping	150 "
" surfacing very carefully with bars	40 "
Car load of gravel loaded by steam shovel	6 yards.
Car load of gravel loaded by hand	8 to 10 "

A foreman should watch and study everything about his work so as to know the cause which leads to every result. If some part is wrong and keeps on getting so each time after repairing, the question "why" should be asked, so as to try and find the cause, and remove that, for prevention is better than cure. Thus if our curve keeps always working out of line it should not be blamed on the engines, and a part of every day's work spent in throwing the track back, but the origin of the trouble should be discovered. Perhaps the curve is too low, or the joints are opposite. Again, if the side of a frog point wears excessively it should not simply be condemned and sent to the shop but, the cause of the wear should be found out, which probably will be that the guard rail is too loose. So if the outside rail of a curve shows heavy wear it means that the elevation is insufficient. These are simple every day samples which serve to show the meaning, and although the large majority of our track foremen work on just this principle, yet there is many a good, faithful man who does not get on in spite of his abilities to work, but who could be made a most useful leader if properly taught to use his intellectual faculties.

FINIS

LITERATURE.

"*Straight Tips*" for Architects, Contractors and Real Estate Owners, Comprising lists of Members of the New York Chapter of the American Institute of Architects, of all Architects in New York and and Brooklyn, of the Members of the Mechanics and Traders Exchange, of officers of the Building Material and of the Real Estate Exchange, with full particulars of the City Departments, and other matters of interest to the building community. Compiled by T. H. BOORMAN. 1885. Price 25 cents.

The title of the above useful little book speaks for itself as to purpose. It is neat in appearance, substantially bound and carefully compiled; it is just the book that ought to be found on the desk of every man interested in the class of business suggested by the ti le-page.

West's Moulder's Text-book: being Part II of American Foundry Practice. Presenting original methods and rules for obtaining good, sound, clean castings and giving detailed description for making moulds requiring skill and experience. Also containing a practical treatise upon the construction of cranes and cupolas, and the melting of iron and scrap-steel in iron foundries. By THOMAS D. WEST, practical iron moulder and foundry foreman, Mem. Am. Soc. Mech. Eng. and of the Civil Engineers Club of Cleveland, Ohio. Fully illustrated. John Wiley & Sons, Publishers, New York, 1885. 8vo. pp. 461. Price, $2.50

This work teems with practical advice on the important subject of iron founding, and the advice is given in a way only possible in an author thoroughly familiar with his subject. The illustration is good and very profuse, and no essential point seems to be left untouched. It is evidently a most useful book to those engaged in the pursuits so well described within its covers.

A Sanitary Survey of St. Louis: Being a series of short papers on leading Public Health Topics contributed by City Officials and Local Sanitarians. With an appendix. Edited by GEORGE HOMAN, M. D. Reprinted from the Transactions of the American Public Health Association, Vol. X, for the St. Louis Local Committee. Concord, N. H., Republican Press Association, Printers, 1885.

This useful publication treates of the situation, surroundings, and soil of St. Louis; its mean temperature; the organization of its health department, sanitary legislation and abatement of nuisances, written by John D. Stevenson, the Health Commissioner; The Sewerage and House drainage of St. Louis, by Robert Moore, C. E.; the water-supply, by Thomas J. Whitman, Water Commissioners; the Street and Alley paving, by John W. Turner, Street Commissioner, and also the milk supply, leading local productive industries, etc., each handled by an expert. As might be expected from the personal knowledge which the writers had of their subjects, the information given upon the various topics is interesting and valuable. The work is illustrated by several very good maps.

A most important book on Cassell & Company's list is "The Story of the Heavens" by Robert Stowell Ball, L. L.D., Fellow of the Royal Society of London, etc., etc. The book, although on a scientific subject, is written in a popular manner, and is profusely illustrated with plain and colored plates of exceptional quality.

Some morning bright we'll wake to find
Profanity acquired:
Our streets with iron netting lined;
Our avenues all wired.

Courier Journal.

WATER

THE long expected celebration of the opening of the Fort Plain, N. Y. waterworks occurred Oct. 6.

THE Troy gas company have distributed their pipes for a new main to Waterford.

PROPOSALS are wanted by East Greenwich, R. I., for constructing works for supplying water for fire extinguishing purposes.

WORK is progressing finely at the reservoir and pumping works location of the Holly Water Works Company at Fond du Lac, Wis.

THE artesian well being drilled at the High School Jefferson, Ill., was completed at a depth of 1,541 feet, furnishing a good supply of pure water.

WORK was commenced October 12th, by the tunnel contractors at the intercepting sewer at the corner of Broad and Spring streets Lynn, Mass.

THE contract for the new 10,000,000 gallon pump for Wilmington, Del., has been awarded to Robert Wetherill & Co., of Chester, who agreed to furnish a Corliss high duty pump for $33,000.

CORRECTION.—In the article on "Sewage Disposal," published on page 234, the address of the patentee of the process is Thomas Dark, 408 North Division St., Buffalo, N. Y.

THE Middleboro, Mass., water-works will be ready for use November 4.

The contract for putting in service pipes has been awarded to Messrs. Trethen & McGee of Taunton.

MESSRS. Cushing and Gibson, to get drinking water on Cushing's Island, Me., have had the solid ledge bored and at a depth of thirty-five feet, struck twenty-three feet of pure, cold spring water.

THE City Surveyor of Allegheny has found a suitable site for the new water-works. It is located at Montrose Station, and is 271 feet above the city level, which will give the water a good descent to Troy Hill reservoir.

THE work on the improvements at the Bangor, Me., Water-Works, under the direction of Mr. Fellows, is being rapidly pushed. It will probably be all finished before cold weather sets in.

WATER-WORKS.—Twenty bids were received for the construction of the water-works at Grand Island, Neb. The bid of the A. L. Strang Company, Omaha, for $33,500 was the lowest.

MONSON, Mass.,—Portland, Concord, and Lowell capitalists have organized the Monson Water-Power and Manufacturing Company, capital $60,000, for the improvement of water-powers.

SCHENECTADY.—The mayor has vetoed the bill authorizing the purchase of the Schenectady water company, on the ground that new works can be built for $15,000 less than the price of the old works. His objection hinges on the cost.

THE trustees of the Cohoes water works association have elected for permanent officers: President, J. W. Hinds; Treasurer, A. J. Griffin; Secretary, Frank B. Peck. It is thought that a Watertown company will be engaged to build the works.

THE coffer dam across the Eau Claire, Wis., constructed to give an opportunity for connecting the water works between the north and east sides of the river, is completed, and the work of pipe-laying will be commenced without delay.

ATLANTA has sunk an artesian well to the depth of two thousand feet without finding water.

THE city of Brooklyn is about to construct a water main across Newtown creek and Commissioner Fleeman has received proposals for the work. The highest bidder was Jos. D. Leary at $1,940 and the lowest Hugh Hart at $1,700.

THE artesian well at Altoona, Dak., flows at the rate of 600 gallons a minute. The upward pressure is about 200 pounds to the square inch, which throws the water to a great height. The surplus water has formed a lake of some forty acres.

AN inspection of the water furnished by the Long Island Supply Company to the people of East New York has been made by Dr. Bartlett. It has been charged that the water is unfit for use. It proved to be pure.

THE oxidization of sewage is one of the latest schemes for insuring public health. The impulsive public, however, has been led to believe that the galvanization of the sanitary authorities might prove equally efficacious.

In a message to the special meeting of the City Council, September 28, Mayor Manning suggested that a competent sanitary engineer be employed by the city to prepare plans for the best means of disposing of the sewage.

OPERATIONS have commenced for putting in gas works in Wellington, Kansas. The engineer will be C. W. Hill, president of the water works. There has been a fight against the public wells and they are being closed to give way to the drinking fountains.

THE report of the engineer at the Peabody, Mass., pumping station for the month of September gives the number of gallons of water pumped as 15,596,080, an average of 586,536 daily, with an aggregate consumption of coal of 42,585 pounds, an average of 1419 pounds daily.

THE Chicago, Burlington and Quincy Railroad Company have just built a large water tank at Rockbridge, Ill., Station, with a capacity of over 50,000 gallons. The water is carried three-quarters of a mile, in a pipe, from Macoupin Creek.

THE Houston, (Texas,) Water-works company have closed a contract with the Shickle, Harrison & Howard Co., of St. Louis, manufacturers, to erect a steel reservoir for the use of the city, 15 feet 30 inches in diameter, and a new pump, with a capacity of 45,000 gallons per minute, to be finished by the 1st of March, 1886.

THE Pond Engineering Company, St. Louis, have been awarded the contract to finish the entire pumping machinery plant for the Abilene, Texas, Water Works to include pumping engines, boilers, heater, feed-pump, and all pipe work complete in the pumping station.

These works are to be in operation by January 1, 1886.

HON. STARKES WHITON, clerk of the Hingham, Mass., Water Company, has called a meeting of the stockholders to hear a report from the directors upon the subject of an additional supply for Nantasket and Hull, and to determine what course to adopt to secure an additional supply.

AT Milwaukee an immense shaft 40 feet deep and 12 feet wide to connect with a terminus of a big sewer is to be constructed for the purpose of allowing an outlet to be built underground for sewerage purposes. The purpose of so large a shaft is to lessen the velocity of the sewage.

THE fresh water supply for Galveston came up for action at a special meeting of the council October 8th, and was deferred until next meeting. A minority report was submitted recommending the bid of O. Chanute, for $45,000 per annum for 300 hydrants, but was subsequently withdrawn and the whole matter laid over.

THE artesian well at Loveland, Col., has at last reached bottom. A new lot of tubing is on the ground, and the work of putting in packers and the new tubing has begun, for the purpose of utilizing the flow, which is considered to be about eighty barrels per day, and about the same quantity of water as that obtained from the wells in Greeley.

THERE is no lack of precedents for reservoir construction on a scale commensurate with that required for the purpose under consideration. The valley of Mareb, in Yemen, Arabia, was irrigated by water distributed from a vast reservoir made by a dam two miles long and 120 feet high, supposed to have been built long before the time of Solomon.

THE Palmer, Mass., water company, has submitted three propositions for a fire service. They offer to put in 14 hydrants, scattered over the village, at an annual rental of $40 each, or they will put in 25 hydrants at a rental of $30 each, or they will put in 25 hydrants and the district may put in 15 more and the company will furnish all the water needed for fire purposes for $750 annually.

TORONTO, ONT.—Superintendent Hamilton, of the water works, will visit Detroit, Mich., to examine the water works system there, with a view to introducing changes in the Toronto works.

THE first artesian well in northern Nebraska began to spout recently on a farm near St. Helena. The contractors made a bargain to secure flowing water at a depth not greater than 600 feet for $1,000. Failing in this they were to receive but seventy-five cents per foot. At a depth of 565 feet they struck flowing water, and earned the $1,000. The water rose in the pipe fourteen feet above the surface.

THE question of a proper and efficient water supply for the new King's County farm has come up for the consideration of the Charities Commissioners. Commissioner Reeves says that there will be no difficulty in procuring an abundant supply of pure water at St. Johnland. Economical considerations and the difficulties incidental to a choice between two or three different systems are the causes of the delay in beginning work on this important improvement.

THE South Mountain Water Co., incorporated at Harrisburg, Pa., last year, propose to the City of Philadelphia to virtually adopt the Water Department's plan of taking water from the Delaware River, at Mt. Pleasant, build the 30-mile conduit riquired and furnish the city with water at a fixed rental. The names of the prime movers in this matter, the capital of the company and the terms of the proposed contract will be given as soon as the formal proposition is made.

CLINTON, Mo.—The City Council has granted a franchise to Alexander & Keefer, of Kansas City, to construct water works for Clinton, Mo. They are to receive an annual rental of $3,500 for 55 public hydrants. Water is to be brought from Grand River, about three miles distant. The work is to begin in about thirty days after the ratification of the contract by the people at a special election, held on the 8th day of October, and to be completed by the 1st of August next.

THE following proposals for two new horizontal pumping engines for the Chicago North Side works were opened by the Commissioner of Public Works October 6th: Deane Steam Company, $97,990; G. F. Blake Manufacturing Company, $92,400; Holly Manufacturing Company, $93,000 and $108,000; E. P. Allis & Co., $105,000; H. R. Worthington, $99,100; Gordon, Maxwell & Co., $94,000; Knowles Steam Pump Company, $197,700. An addition will have to be made to the building to accommodate the new engines.

THE upshot of the water controversy at Jersey City will, in all probability be the introduction of the water meters. Under the present system of water rates, a private dwelling with one or two families is taxed the same as a house with ten or twenty families. The most opposition to the meter system comes from the owners of houses in the meadow district. The Hackensack Water Company will put in no meters until after the conference with the committee appointed by the Citizens Association.

FOND DU LAC, WIS.—Mr. W. R. Coats, sanitary engineer, presented to a special council meeting, September 25, a report on a system of sewage made in compliance with instructions of the Mayor and council. Mr. Coats advocates dividing the city into several sewerage districts with different outfalls and the adoption of the small-pipe system, storm-water being excluded from the sewers. Council will take no action at present.

COLUMBUS, O., FILTERING GALLERY.—The new filtering galleries, now being extended for the Columbus Water Works, are now 6,700 feet long in the aggregate. They run through a water-bearing gravel and yield at present 5,000,000 gallons in 24 hours. This quantity of water being now hardly equal to the demands upon it an additional tunnel, or gallery, 3,000 feet long is being constructed. This new gallery is about 20 feet below the surface, and 3½ feet inside diameter; it is built of brick, laid with 2-inch openings in the sides. The yield of water from this newly-tapped stratum is very great; though only 500 feet of the proposed gallery is finished the pumps are now throwing from the excavation over 4,000,000 gallons per day. The estimated yield is 10,000,000 gallons, which with the quantity now available will give Columbus over 14,000,000 gallons per day, or enough to last her for ten years at least.

AT a meeting of the Sacramento, Cal., Board of Trustees, October 5, Trustees Jones and Nielsen and City Engineer Bassett, who had just returned from an inspection of the property of the California Water Company, on the Georgetown divide, in El Dorado county, said they would submit a written report on the following Monday. They had made a very careful and close inspection of the water of Loon Lake and its feeders, and while they thought their waters pure, and what the city wants, they were of the opinion that they could not be transmitted to Sacramento in a pure state unless piped from about Tunnel Hill or some point upon the Rubicon. The citizens of Georgetown, they say, do not use the water for domestic purposes, but the committee attribute that more to the fact that they have wells of sparkling cold water in every door yard, which cost them nothing, and than which there is no better.

HUNTINGTON, Oct. 13.—Peter Herdic, erecting water works here, has begun digging a large basin on an island above here into which the water from the river is expected to filter through the sand and from which it will be pumped into a reservoir on one of the highest hills hemming in the town on the north. There is much dissatisfaction at this move, since the river water is thought very unwholesome, as within twenty miles it does all the drainage of six towns, several paper mills and their usual concomitants. A few months ago samples of river water were analyzed by Dr. Leffman, of Philadelphia, who found that it contained about forty grains of solid matter to the gallon, of which one-fifth is chloride in combination with nitrates. The people understand this analysis to mean that the water is highly impure and they are aware of the fact that fish cannot live in it a few miles above this place and that cattle refuse to drink it. A great many people, therefore, say they will not have such water in their houses.—Philadelphia *Press*.

CONEY ISLAND SEWERAGE.—The Gravesend Board of Health met at Coney Island Police Headquarters, October 6th, and by a unanimous vote decided to take immediate steps in the matter of Sewerage for District 6, (Coney Island.) Town Clerk Vorhees, as Secretary of the Board reported that of 112 property owners upon the district assessment roll, seventy-four had already signed their names in favor of the sewerage, and that others had yet to sign. Health Officer Van Kleek, in a lengthy report, stated that the district was in a condition detrimental to health for the want of a proper system of sewerage, and that the relief should be granted as soon as possible. Justice Stryker then offered the following resolution:

Resolved, That this Board hereby declares that the condition of District 6 is detrimental to public health, and that the Board immediately provide a proper system of sewerage in accordance with the provisions of Chapter 493 of the laws of 1885, for the relief of said district.

The resolution was unanimously accepted and voted to be placed on file.

A NEW PROCESS FOR SEWAGE-PRECIPITATION.—Luton, one of the towns which is drained into the river Leah, has had for a long time under consideration, the imperative necessity of increasing the existing means of dealing with its sewage.

A system of sewage-precipitation, the invention of Mr. Cobley, of Dunstable, has recently been tried with successful results.

The affluent is unusually difficult to deal with, as, in addition to ordinary town sewage, it is dyed a dark blue-black color by the refuse from straw-plait dyeing, which is the staple industry of Luton.

The precipitating material is an intimate mixture of clay and coke dust, raised to a high temperature in retorts, and subsequently treated with crude sulphuric acid. The resulting black powder is thoroughly stirred up with water, and delivered into the sewage in a graduated stream; powdered chalk is also added at Luton, in order to get rid of the coloring matters.

After treatment a copious precipitate falls into the settling tanks, and the effluent water is clear, colorless and odorless. The process is said by its inventor to be very economical as well as effective.

The sludge, it is believed, can be baked and used over again, two or three times until a valuable manure is obtained. Provisional protection has been obtained. —*British Medical Journal*.

MATERIAL FOR DYKING.—The best material for dyking against mill-tides and polluted streams is probably gravel. The next best is sand. Stone is likely to be scarce in our broad and rich alluvians that will pay in crops for the labor of dyking. If we examine the firm banks of our streams we shall find them composed largely of sand. Sand and water make a feasible soil But we shall observe, too, that the sandy, firm and dry banks of streams covered by sweet grass have risen and increased very slowly in a state of nature. Not so much as one quarter or one half inch yearly, perhaps has been added. We should risk losing a sand dyke in the very next freshet unless it is solidly grassed over at once, or we are very lucky, or we choose to imitate the slow process of nature in making strong banks by applying at one time only what the sward will hold and live. Gravel, however, can be used in larger quantities, especially in wet places where it will pack and give trusty footing for teams and wheels almost at once. Floods will not so readily melt it away. Sods are rather spongy material when dumped in any bulk in or against water. We have proven recently that sandy earth, taken from under the sod, with scarce a fiber in it gives firmer wheeling than sods will. Muskrats do not like gravel, and clean gravel is not shaken by frost. These are very important points in any work of this kind. Stiff clay may do to fill the bottom of a wet hole with and so will any sort of rubbish—stones, brickbats, coal-ashes or whatever. Brush beaver-dam wise, for deep inlets on the bank of a stream is almost indispensable in making a cheap bridge for teams and to break the force of currents. Pains should be taken to fill firm earth or gravel among the brush or it will prove to be a water conductor. The choice of grass for holding the banks of streams is a study by itself.

THE mineralogists of Washington are keeping a careful watch upon the progress of the great water-works tunnel which traverses the rocky highlands in the northwestern part of the city, and a series of specimens is to be gathered at intervals of fifty feet, throughout its entire length of 21,400 feet, for preservation in the National Museum. Already many minerals hitherto unknown in the District of Columbia have been brought to light.

THE city engineer of Boston, reports that the daily average consumption of the Sudbury and Cochituate water during the past month has been 26,493,609 gallons, an increase of 4 per cent. from September, 1884. At the Highland pumping station the daily average amount pumped has been 2,493,950 gallons, a decrease of 3.7 per cent. from that of the corresponding month of last year, and the daily average consumption of the Mystic works has been 5,931,900, a decrease of 7.5 per cent. from that of September, 1884.

THE BELLEVILLE WATER WORKS, ILL.—Water was turned on the distribution system of these works on September 30, one day within the contract. The work was formally tested on October 6, and though the test was severe, the five streams being taken with the 4 and 8-inch pipe, it was very satisfactory, and the work was formally accepted by the city. The water works include a storage reservoir of 30,000,000 gallons capacity, made by damming Richland Creek and excavating about twelve acres to a depth of 12 to 8 feet; a filter basin of 1,500,000 gallons capacity, lying in a bay of the storage reservoir, and cut off from this by a dam, covered with four and a half feet of gravel and sand on the reservoir side, and the filter side paved with brick, the drains lead through the dam. The distributing reservoir, of 3,000,000 gallons capacity, is 18 feet deep, and connected with the filter basin by a 20-inch conduit pipe. The pump house contains two Compound Duplex Worthington pumps, of a joint capacity of 2,500,000 gallons in twenty-four hours: two Whittier tubular boilers of 70 horse-power each furnish the power required. There is a water-tower on a hill 17 feet above any other point in the city, and in itself 115 feet high; the diameter is 15 feet, and capacity about 150,000 gallons. There are nearly 11 miles of cast-iron pipe in the distribution, ranging from 14 to 4 inches, with 100 fire-hydrants. The city pays $75 per annum rental for each hydrant. The average track in the city is 132 feet. The projects for private and manufacturing consumption are very good. The works were built by a private company. H. C. Comegys and T. E. Lewis, of New York, were the contractors, and Col. S. H. Lockett was the chief engineer. Work was commenced April 1, 1885.

NEWS OF THE WEEK.

Railroads, Bridges and Canals.

V. V. & I. R. R.—The contract for the construction of the Verdigris Valley and Independence Railroad has been signed.

The Union Pacific Road is preparing to replace the bridge over the Big Moody at Train Table, Neb., built in 1872 at a cost of $1,500,000.

C. P. R. R.—A second staff of engineers has been dispatched to re-measure the disputed sections of the Canadian Pacific, Lake Superior section.

Point Pleasant Bridge—POINT PLEASANT, W. VA., Oct. 13.—Work on the superstructure of the new railroad bridge, began in earnest to-day.

The Napanee & Tamworth Railway.—A deputation has been appointed by the Kingston, Canada, board of trade, to arrange for the running of the Napanee & Tamworth Railway into that city.

Manitoba R. R.—A St. Paul firm has entered into contract with the Manitoba Railroad Company to build this fall twenty-five miles of road from St. Cloud in the direction of Wilmar.

The Savannah Valley Road.—The work of building the Savannah Valley Railroad is being pushed ahead with all possible dispatch. A force of 125 hands are now employed on the line under Capt. G. D. Wadley.

New Kansas R. R.—The bonds for the Hutchinson and Kinsley railroad were carried by a majority of three hundred. This road will be built at once, and is an important line for the city.

Against the Railroads.—ATLANTA, Ga., Oct, 9.—The House of Representatives to-day defeated the bill amending the railroad commission laws so as to grant roads the right to make their own rates subject to revision only on complaint. The bid received eighty-three votes, while eighty-eight were necessary to its passage.

The New York, Chicago & Council Bluffs Railroad was organized, with the following directors: William B. Whiffen, Gustavus A. Moatz, Newton Wyeth, Ambrose Plamondon, Charles A. Plamondon, James F. Dane, Cyrenius A. Layton, Johnson M. Burdge, Lindley M. Ninde, James B. White and Isaac B. Hymer.

The object of this enterprise is to construct a line from Lacon., Ills,, on the first-named road, to Wheeling, W. Va., touching Wabash and Bluffton, Ind.

Black Hills R. R.—When in Omaha, Neb., this week Jay Gould stated that it is proposed to build a road direct from that city to the Black Hills, through the Elk Horn Valley.

Prisco & Fiocrella, Contractors, have finished five miles of track from Lebanon, Ind., east, and will in a few weeks complete the road from Lebanon to Noblesville, Ind.

R. R. Commission.—Robert B. Roosevelt, of New York, Augustus S. Merriman, of North Carolina, and William Stevenson, of Pennsylvania, have been appointed a commission to examine and report upon twenty-five miles of the Northern Pacific Railroad lying between Engle Gorge, Washington Territory, and the south bank of the Puyallup River.

Brooklyn Bridge.—Traffic over the East River Bridge has increased something like 20 per cent. within the last four months. At times the passengers number over two per second one way. It took two years after the opening of the bridge to roll up the first 25,000,000 passengers. Up to this time the increase of traffic has exceeded expectations.

Ordnance.—Congressmen Randall of Pennsylvania, Crisp of Georgia and Reed of Maine, of the committee appointed to examine the facilities of the country for the manufacture of ordnance, have visited the Watertown Arsenal, they have also inspected the South Boston iron works, where guns of the heaviest calibre are cast.

Bridging the Mississippi.—The Minnesota and Northwestern Road has completed its bridge across the Mississippi River at St. Paul, Minn., Work was commenced the first of last December, the piers being sunk through the ice, and it has been finished in the remarkably short time of ten months. The bridge is of iron, 1,825 feet long, and the draw span, 412 feet long, is the largest and heaviest in the world. The cost of the bridge was $350,000.

The East Broad Top Road is completed to within six miles of Burnt Cabins, a point on the South Penn route, and it is believed that the two roads will be connected at Burnt Cabins, and, utilizing the Tuscarora tunnel, unite the East Broad Top with the Cumberland Valley branch at Richmond. This would make a short route from Chambersburg to Mount Union, on the main line of the Pennsylvania, and give near access to the Broad Top coal fields.

New Road in Alabama.—A declaration has been filed with the Secretary of State of Alabama to incorporate the "Sheffield Terminal Railway Company," and a commission issued to a board of corporators consisting of Wm. B. Wood, R. G. Hervey, Henry Habbder, Enoch Ensley and Philip Campbell. The object is to build a road from Tennessee river landing to the junction of Nashville avenue and First street, with power to build northward to the Tennessee State line. The capital stock is put at $250,000.

A New Railway Company.—Articles of incorporation have been filed at the State House of Wisconsin of the Bayfield Harbor and Great Western Railway Company, which proposes to run a line from Bayfield southwest to a point on the Minnesota State line in Douglas County; also a branch from the main line in Douglas County to a point in Wisconsin opposite Still water, Minn., a total length of 200 miles. The capital stock is $5,000,000. The incorporators are W. F. Dalrymple, G. H. Noyes, and D. C. Millett, of Milwaukee; Oliver Dalrymple, of St. Paul, and D. F. Glover, of Bayfield.

Ohio Valley R.R.—Ground was broken Sept. 7, at Henderson, Ky., under contract for the construction of the Ohio Valley Railroad, the terminal points of which are Henderson, Ky., and Jackson, Tenn. Twenty-five miles of the road are to be ready for the iron by December 31, 1885, and fifteen miles more by May 1, 1886. The iron, track materials and engines have been purchased. The contract for the construction of the first forty miles has been awarded to J. H. McMichael, J. R. Terfell and Marshall Morris, of Louisville. This road is being built by a syndicate of Pittsburg capitalists, headed by Capt. S. S. Brown.

The Charlotte Harbor Extension of the Florida Southern railroad, from Bartow to Charlotte Harbor, Fla., is being pushed forward very rapidly. Work was begun under the supervision of Maj. W. P. Couper, chief engineer, about July 20, at which time the line was located. Since then thirty-five miles of the road have been graded, and 100,000 cross-ties got out. There are 1,600 men at work building the road. The line has been located as far as Fort Ogden, on the east shore of Charlotte Harbor, and several preliminary surveys have been made further south towards Fort Myers and Punta Rassa, but the positive objective point is not yet determined. There are three gangs of bridge hands at work, and it is expected that track-laying will commence on November 1. The principal contractor for the grading and track-laying is L. O. Gold. The sub-contractors are Messrs. Marquise & Creary, Thaggart & Bostick, J. E. Visage, H. Griffin & Co., and Col. W. J. Winn. The contractors for the cross ties and trestling are Messrs. Waters & Wright, and the sub-contractors are Capt. Reid and Mr. W. Pittman.

Missouri & Nebraska.—KANSAS CITY, Mo., Oct. 12.—A party of surveyors to-day began work on the proposed line between Kansas City and Beatrice, Neb.

The Gulf Canal.—The incorporators of the Atlantic and Mexican Gulf Canal Company will meet in Savannah early next month for the purpose of organization under the charters recently granted by both the Georgia and Florida Legislatures. The plan is the same as that contained in Gen. Gillmore's survey. The canal will be about 200 miles long, extending from the mouth of the St. Mary's river on the Atlantic coast to St. Mark's on the Gulf coast, through the Okeefinokee swamp.

Georgia Legislature.—Bills passed: To incorporate the Marietta and Austell railroad.

To incorporate the Athens, Gainesville and Eastern railroad.

Incorporating the Monticello and Eatonton Railroad Company.

Incorporating "The Savannah-Tybee Railroad Co.

Incorporating the Columbus and Northern Railway Company.

Incorporating the Waco and Bowden Railroad Co.

Swedish Railroads.—Some interesting comparisons of the working of State and private railways in Sweden are given in a recent blue-book. The particulars refer to the year 1883. Sweden has about 4,100 miles of railway, of which there are 1,437 miles of State railways and 2,663 belonging to private companies. The total earnings for 1883 amounted to £2,170,186, and the working expenses to £1,216,326. The net earnings on the cost of the State railways was 3.65 per cent., and on the private railways 4.82 per cent. The working expenses on the State railways averaged 60 per cent. and of the private lines 50.7 per cent; but the most remarkable comparison is in the class of earnings. On the State railways 37 per cent. of the earnings were received from passenger fares and 62 for goods traffic, and on the private railways 28 per cent. for passengers and 70 per cent. for goods traffic, the small percentage over in each case being made up by miscellaneous receipts. Presumably the State lines offer superior accommodation to passengers.

English Railways.—The official figures concerning the British railway system show that the increase of express trains during the last twelve years has been 157, or 62.8 throughout the English and Scotch lines, the number increasing from 250 per day to 407. The average journey speed has increased four miles per hour, the running average about the same, and the total express mileage from 23,672 to 42,693, a daily increase of some eighty per cent. At the head of this vast system, as regards express mileage, stands the London and Northwestern, with 10,405 daily miles. But the Great Northern stands first in the running average increase, showing an advance from forty-two to forty-six and three-fourths; and the total express mileage on this route has risen from 3520 to 6780, or ninety-two per cent. The Manchester, Sheffield and Lincolnshire shows the largest increase of all the lines in the number of district expresses, having risen from eleven to forty-nine; its average speed also has mounted from thirty-six to forty three miles, in which matter it is surpassed only by the Glasgow and Southwestern, which increased by nearly eight miles. The running average of the Manchester and Sheffield has increased six per cent., and its total express mileage 280 per cent.

Increasing the Capacity of Railroads.—D. Brock, superintendent of transportation on the Missouri Pacific, told me that in the march of invention in the railroad business, and in appliances for lessening the cost of transportation, he regards the Eastern roads as fully ten year behind the West. On every Western road, experiments are being made toward the perfection of railroad service, while in the East the management is set in old grooves. "The thing now most discussed with us, is the stoppage of freight trains," he said. "We have found automatic brakes that enable us to stop a heavy train at the option of the engineer in just about one-third the time and distance that it can be done under similar conditions with hand brakes and a crew of men. For instance, we stopped a train with the automatic brakes in 29 seconds, and 752 feet, and on making the test of a similar train on the same grade with five men standing at the brakes for the signal, found that the best they could do was 76 seconds and 2,150 feet. Under ordinary circumstances they would have been in the caboose and a much longer time would have elapsed. The point in these improvements is that we can run freight trains at double and treble their present speed if we can only control them. That means that the carrying capacity of the railroads of the country will be doubled or trebled."—*N. Y. Tribune.*

Powers of the Bridge Commission.—Corporation Council Lacombe has written to Jacob Lorillard, Chairman of the Harlem Bridge Commission, advising him that under the law creating it the commission has full power to advertise for plans, specifications, and estimates for the proposed bridge, to adopt plans presented and then advertise for proposals for constructing the bridge. The Commissioners are not bound to prepare plans and specifications and advertise for proposals according to the provisions of the city ordinances. The law under which they act gives them an unrestricted grant of power to provide material, employ laborers and fix their compensation, and under such a grant public officers may do their work in such manner as they see fit. The Corporation Counsel, however warns the commission that the cost of the material, labor, and services, and the necessary expenses connected with the bridge are to be paid by the city, which is now indebted beyond the limit of 10 per cent of the assessed valuation of its taxable real estate, which is the extreme indebtedness it is capable of creating under the constitutional amendment which took effect on Jan. 1. The constitutional prohibition would therefore apply to any contract which the commission might seek to make in advance of action by the Board of Estimate and Apportionment providing funds to meet such contract.

Central Pacific R. R.—The company will push the California & Oregon line rapidly if Congress gives the land grant, but will proceed under any circumstances. The cost of building from Delta to Strawberry valley will exceed $60,000 or $70,000 per mile, with a heavy expense, also, from Klamath river to the Oregon line, so that in all probability at least $5,000,000 will be needed to complete the road to the line. The company is negotiating for the Oregon line, and expect to secure a lease.

The railroad builders are now finishing up tunnel No. 8, to which the approaches had been cut before suspension of work last year, and expect to finish it within three months, so that supplies can be run up to Slate creek from Delta. Gangs of men are also to be set to work in boring tunnels 9, 10 and 11, for the purpose of getting them open for transit by next spring, so that supplies can be carried still further on by rail, for the grading, bridging and other work.

The Siskiyou mountain tunnel is altogether too high in grade, and about half finished through the mountain, and it is likely to be abandoned for a new tunnel. The road through Oregon is poorly constructed, especially between Roseburg and Ashland, so that it will be thoroughly overhauled no doubt as soon as leased by the Central Pacific, as the lease is a virtual purchase, extending over a period of ninety-nine years.

Railroad Matters in Tennessee.—GALLATIN, TENN., Oct. 10.—Maj. J. W Blanchard reports that the line of the Middle and East Tennessee R. R., has been run, and rough estimates made—$30,000 per mile.

Chief Engineer Wm. Spradlin, of the Nashville & Chesapeake Railroad, arrived at Gallatin to-day from a trip over the line to Scottsville, Ky. Work on the line is being pushed rapidly, Rodemer having a large force of hands upon the heavy work of the road.

Docks.—Mr. Warren Roosevelt has just commenced the construction of an immense dock at Pamrapo, N. J. for the firm of Morris & Cummings, of this city. It will cost over $300,000 for building. The crib work of the dock will be composed of 2,000,000 cubic feet and will take 1,500,000 square feet of timber. When the docks are completed a channel will be made so as to permit vessels of deep draught to enter. The deepest water at present is thirteen feet and that only in a few places.

The international Docks at South Brooklyn have been completed and are ready for the reception of vessels.

A New Ship Canal.—Judge Whiteley, Wilmington, Del., has granted the application of the Maryland and Delaware Ship Canal asking for a commission to condemn and set aside certain land for its use and to make an award of damages to the owners. This removes the last obstacle to the construction of the canal, and the important work will be started as soon as the matter of right of way has been disposed of, which will be within 60 days at most. The great work was projected about 15 years ago and a survey made, upon which the cost was estimated at $8,500,000. In 1873 a charter and act of incorporation was obtained, but opposition deferred the company from commencing the work. The Sassafras route has been adopted, the terminal points being the Sassafras River, which empties into Chesapeake Bay, and Leston's Point, on the Delaware Bay. The water belt is to be seventeen miles long, fifteen miles of its course being in Delaware, directly across the peninsula. It will be 100 feet wide and twenty-seven feet deep at low water.

This canal will shorten the route between New-York and Baltimore by sea 222 miles, and Baltimore and European ports 250; via the ship canal and Delaware Bay 250 miles. There are various estimates as to the time required to complete the work, which will probably take from three to five years. The firm of Ferguson & Fairchild, New York, have the contract for the entire construction, and state that owing to the improvement in excavating machinery it can be finished for less than $8,000,000. The company is composed of New York, Philadelphia, and Baltimore capitalists, and it is believed that Jay Gould is a heavy shareholder, as he was one of the original projectors of the enterprise.

Contracting.

New York City.—The Department of Public Charities will receive proposals until Oct. 27, for skilled labor to erect and complete a pavilion on Hart's Island

Rolling Stock.—The Jackson & Sharp Company is building six passenger cars for the New Brunswick railroad.

Track-laying.—William O'Meara, of Wilmington, Delaware has been awarded the contract for laying the "Y" connection between the Baltimore & Philadelphia and Wilmington & Northern railroads, through Alvan Allen's brickyard.

Chicago Street Improvements.—Contracts have been let for the improvement of streets, the price varying from $1.09 to $1.18 a square foot for cedar blocks, the lowest of the year. The work is to be done at once.

Railroad Contract.—Mr. Si Cochran, of Columbus, O., has contracted with the Chautauqua Railroad Company to build twenty-five miles of road between points on Chautauqua Lake.

Steam Heating.—Samuel I. Pope & Co., of Chicago, have received contracts for the steam-heating of the new Custom-House and Post-office buildings at St. Paul Minn., and Buffalo, N. Y., for $7,000 and $15,000 respectively.

Bridge Contract.—The contract for building the stone bridge on the English drive, New Haven, Conn, where it crosses the Indian Neck road has been awarded to the firm of Redfield & Sons. The building of the bridge will be begun immediately.

Table Showing Present Price of Labor per Day in the Several States Indicated.

CLASS AND KIND OF LABOR PER DAY.	Ohio.	Indiana.	Michigan	Illinois.	Missouri.	Wisconsin	Minnesota	Nebraska.	Iowa.	Kansas.
Pressed Brick Mason	$5 00	$4 50	$4 00	$5 00	$4 50	$2 50	$5 00	$5 00	$5 00	$5 00
Common Brick Mason	3 50	3 50	3 50	4 00	4 00	2 50	4 00	4 50	4 00	4 00
Stone Mason	2 50	2 50	3 50	2 50	1 75-2 50	2 50	3 50	3 50	4 00	3 00
Carpenter	2 50	2 00	2 25	2 00	2 50	2 00	2 50	2 50	2 25	2 50
Wood Finisher	2 00	2 50	2 50	2 25	2 75	2 00	2 50	3 50	3 00	2 75
Painter	2 00	2 00	2 50	2 00	2 50	2 00	2 50	2 50	2 50	2 50
Grainer	2 50	2 50	3 00	2 50	3 00	2 00	2 75-3 00	3 00	3 00	3 00
Plumber	2 75	3 00	3 00	2 00	3 50	2 50	3 00	3 50	3 00	5 00
Gas Fitter	2 25	2 50	3 25	2 50	2 75	2 50	3 00	2 50	3 00	3 50
Stone Cutter	2 75	3 50	3 50	2 00	3 00	3 00	3 50	4 00	4 00	4 00
Tinner	2 00	2 00	2 50	3 00	2 50	1 75	2 50	2 50	2 50	2 50
Steam Fitter	2 50	2 50	3 00	3 75	2 75	2 00	3 00	3 00	4 00	3 50
Sewer Builder	3 50	1 75-2 00	2 25	4 00	3 50	3 00	3 25	4 50	6 00	3 25
Tucker	3 25	3 00	3 50	3 75	3 00	2 50	4 00	3 50	4 00	3 25
Laborer	1 25	1 50	1 50-1 75	1 50	1 25-1 50	1 25	1 50	1 50	1 75	1 75

Present Average Price of Standard Building Material in the Several States Indicated.

KIND MATERIAL.	Ohio.	Indiana.	Michigan	Illinois.	Missouri.	Wisconsin	Minnesota	Iowa.	Nebraska.	Kansas.
									ſton.	
Building Stone, per Cord	$ 1 25	$ 9 00	$9 00 10 00	$ 2 25 3 00	$12 00	$ 6 00	$ 5 00	$20 00	$ 2 50 3 00	$ 8 00
Common Brick, per M.	4 50	5 00	5 00	6 00	7 50	10 00	8 00	6 50	10 00 12 00	6 50
Pressed Brick, per M	20 00	20 00	8 00 28 00	30 00	30 00	12 50	37 50	40 00	18 00 20 00	12 00
Cement, per Bbl	1 25	1 00	1 50	1 10 1 50	1 40	1 75	1 50	3 75	3 50 3 25	3 00 5 00
Lime, per Bbl	90	17c. Bu.	1 00	65	1 10	20	75	60	1 75 1 65	2 10
Slate, per M	4 50	8 00	8 00 10 00	8 00	12 00	9 00	9 75	10 00	7 00	9 00
Lumber, Common, per M	17 50	1 50	12 00	14 00	12 00	12 00	12 00	15 00	18 00 25 00	18 00
Lumber, Finishing	30 00	3 50	30 00 40 00	30 00 50 00	32 00	38 00	30 00	45 00	45 00 60 00	30 00 45 00
Lumber, Oak, per M	15 00	2 25	20 00	25 00	45 00	50	35 00	45 00	40 00 80 00	35 00
Lumber, Cherry, per M	20 00	7 00	50 00	90 00	90 00	1 00	90 00	90 00	1 50	75-1 00
White Lead	6 50	5 75	6 00	6 00	6 00	6 00	5 65	6 50	6 00	6 50
Linseed Oil	60	60	60	65	63	65	60	50	65	67
Nails	2 25	2 40	2 30	2 75	2 75	2 40	2 65	2 50	4-6	2 75

—The Chicago National Builder for October.

Proposals for constructing a system of water-works are asked by the authorities at Fort Niagara, N. Y. They opened October 13. Address Lieutenant R. G. Wood, A. A. Q. M., Fort Niagara N. Y.

El Paso, St. Louis and Chicago Road.—AUSTIN, TEX. October 10.—The charter of the El Paso, St. Louis and Chicago Railway and Telegraph Company was filed here to-day. The road runs north to the southern boundary of New Mexico; capital, $100,000.

Government Building.—WASHINGTON, Oct. 7.—Contracts for foundation and basement of the government building at Minneapolis were let to-day by Secretary Manning to McGowan of Washington for brick work at $11,900, and the Minnesota Stone company for stone work at $21,400.

Town Hall.—PROVINCETOWN, Mass., Oct. 9.—The contract for building the new town hall has been awarded to J. W. Jobling, of Boston, for $26,515. Work will be rapidly pushed forward. The new building will be a handsome two-story wooden structure, nicely finished throughout.

Chignecto Ship Railroad.—The contracts for the construction of the Chignecto Ship Railroad across the isthmus between Northumberland Straits and the Bay of Fundy have been closed. It will be about twenty miles long, and its estimated cost is $5,000,000. The Canadian Government has agreed to grant a subsidy of $172,000 yearly for twenty years.

An Arizona R. R.—A New York and Minnesota syndicate, is building a railway line in Arizona, from the Atlantic and Pacific to Prescott. The work of construction was began June 2, and so far fifty-five miles have been graded. It is expected that the work will be finished by March next. It is an independent line. Major C. M. Wilson is the executive head.

Safe Deposit Vaults.—James G. McIntosh & Co., of Springfield, Mass., have awarded the contract for all the vault work and safe-deposit work for the new safe deposit company to be located in this city, amounting to about $25,000, to the Damon Safe and Iron Works company of Boston. The vault doors will be supplied with Damon patent gravity automatic bolt work, and all the work will be supplied with the latest dynamite safety devices.

New Canadian Line.—Orders in council have been granted authorizing and issuing a charter to the Temiscouata Railway company to build a railway under the act of last session, from Riviere Ouelle or Riviere du Loup to Edmonton, N. B.; the charter members are A. R. McDonald, superintendent of the Quebec division Intercolonial railway; P. E. Grandbois, M. P.; Demas Bossignal, of Riviere du Loup; G. H. Deschenes, M. P. P., of St. Ephanie; J. J. McDonald, Ottawa; A. Hamel, J. I. Tarte, Quebec, and C. Bertrand, Isle Vert.

Gulf, Colorado and Santa Fe Extension.—FORT WORTH, TEX., October 10.—Alderman W. H. Aldridge, just returned from Galveston, reports that the Gulf, Colorado, and Santa Fe, will next week put a surveying party in the field from here to Gainesville to locate the line for the extension of the road, work to begin at once, and to be pushed with vigor. The company proposes to build to Tulsa, in the Indian Territory as fast as possible, to a connection, first with the St. Louis and San Francisco, and later to a connection with the Atchinson, Topeka and Sante Fe.

Building a Railroad at Night.—The construction of the Transcaspian Railway proceeds slowly. In compliance with Gen. Annenkoff's directions, the work is as far as possible carried on at night by means of lanterns. The chief cause, however, of the slow pace complained of is the large number of bridges which have to be constructed at almost every verst across the small water courses emanating from the neighboring hills, and dry except in winter and the autumn. As all the bridges are constructed of stone arches and are not pile bridges, the time required is obviously considerable. The heat at present is almost insupportable. Lately the thermometer has been standing at 122° Fahrenheit.

Altoona, Pa. Sewers.—At a meeting of the Highways and Sewers Committee, October 6, the following bids were considered: J. F. Storm, of Altoona, for 21-inch sewer on Sixth Avenue, $1.52 per lineal foot, for 18-inch sewer on Sixth avenue $1.24 per lineal foot.

F. J. McGovern, of Tyrone, 21-inch sewer, $1.43 per lineal foot. 18-inch sewer $1.37 per lineal foot.

Kelly, Wylie & Co., of Altoona, for 21-inch sewer, $1.34 per lineal foot; 18-inch sewer, $1.12 per lineal foot, except inlets; for Howard avenue 20-inch sewer, $1.05 per lineal foot. For the sum of $8,200, the firm engaged to do all the work and furnish all material for the building of the three sewers.

Thomas G. Martin Altoona, bid for 21-inch sewer, $1.35 per lineal foot: for 18-inch sewer, $1.13 per lineal foot.

H. R. Hill, Williamsport, Pa., for the 21-inch sewer, $1.34 per lineal foot, for the 18-inch sewer, $1.22.

The contract was awarded to Kelly, Wylie & Co., with the understanding that they were to construct the three sewers for the sum of $8,200.

Sewer Bids.—Bids were opened October 5th, for the construction of sewers at Columbus, O., in sub-sewer district B of Main Sewer District No. 2, as follows: Evan Moses, (1) excavation and back filling 17¼ cents, (2) 24-inch pipe $1, (3) 20-inch pipe 70 cents, (4) 18-inch pipe 60 cents, (5) 15-inch pipe 40 cents, (6) Y connections on 24-inch pipe $4, (7) same on 20-inch pipe $2.80, (8) same on 18-inch pipe $2.40, (9) same on 15-inch pipe $1.60, (10) brick laid in manholes per 1000 $11, (11) manhole frames and covers $10, (12) lumber left in per 1000 feet $18. Thomas Jordan, (1) 17½ cents, (2) 80 cents, (3) 60 cents, (4) 46 cents, (5) 35 cents, (6) $2,50, (7) $2, (8) $1.50, (9) $1, (10) $10, (11) $7, (12) $11. E. M. Stanley, (1) 35 cents (2) $1, (3) 70 cents, (4) 60 cents, (5) 40 cents, (6) $4, (7) $2,80 (8) $2.40 (9) $1.60, (10) $11, (11) $9, (12) $20. Knight & Bro., (1) 20 cents, (2) 87 cents, (3) 59 cents, (4) 52 cents, (5) 35 cents, (6) $2 50, (7) $1.75, (8) $1.50, (9) $1, (10) $9.50, (11) $9, (12) $10, John E. Gillivan, (1) 17¾ cents, (2) 98 cents, (3) 65 cents, (4) 45 cents, (5) 35 cents, (6) $2,50, (7) $2, (8) $1.50 (9) $1, (10) $10, (11) $7, (12) $12.

Recent Patents.

Car Truck.—*Moses G. Hubbard, Norristown, Pa.* A flexible arrangement of frame and springs for four and six wheeled trucks. Nos. 326, 652, 326, 653, 326, 654.

Coffer Dam.—*Eli F Reaume, Amherstburg, Ontario, Canada.* A coffer-dam having a rectangular base, with an outer inclined frame and an inner frame with stays between; the inner frame being provided with doors. No. 326,783.

Sleeper for Permanent Ways.—*Peter Kirk, Workington, England.* Metal cross-ties with jaws or clips for holding the rails punched and pressed from the metal of the tie. No. 326, 874.

Structure for Submarine Sewers.—*Henry Case, Brooklyn, N. Y.* The pipes are carried on bearers resting on piles and tied by chains to brace piles. No. 326, 544.

Tunneling Shield.—*Albert Krause, Buffalo, N. Y.* A movable tubular shield has the front edge inclined to the angle of repose of the material being tunneled. The upper and lower parts of this edge are separate, and a platform is provided at half the height of the shield, with a door to close the lower space. No. 326, 659.

Market Report of Engineering Materials.

New York, October 15, 1885.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer, and both the range of material and the market location will be extended as rapidly as possible. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.		
Angles	2. @	2.1
Tee	2.2 @	2.4c.
Beams and channels American	3.0c. @	
Tank	2. @	2.1c
Shell	2.4c. @	2.5c
S eel plates, Tank	2¾c. @	3c.
WROUGHT-IRON PIPE.. PITTSBURGH.		
Butt welded, black ... Discount	42½ @	45
" " galvanized ... "	35	
Lap welded black ... "	60 @	62½
" Galvanized ... "	45 @	42½
Boiler tubes	57½	
RAILS.		
Steel (large lots at mill)	29.00 @	30.00
Old rails	17.25 @	17.50
Old rail steel	17.00 @	18.00
R R. spikes	1.8 @	1.9
R R. splice-plates	1.65 @	1.7.
R R. Track Bolts Square Nuts	2.55 @	2.65
Barb-wire fencing, galvanized		4.50
" painted		3.50
Corrugated iron		
Nails		
Iron	2.50 @	2.60
Steel	2.65 @	2.75

METALS.

COPPER.	
Lake Superior	11 @ 11¼
Other Brands	10¾ @ 11¼
LEAD.	
Com. Domestic	4.15
Lead Pipe	.05¾
Tin-Lined Lead Pipe	.15
Sheet Lead	.06¾
ZINC.	
Sheet	5.75 @ 6.00

BRICK.

(Cargoes afloat)		
Haverstraw ... per M.	$5.57 @	6.00
Fishkill		
Up-River	5.25 @	5.87½
Jerseys	4.50 @	5.50
Long Island		
" pale	3.00 @	3.50
FRONTS.		
Croton red	11.00 @	14.00
" dark	11.00 @	14.00
" brown	10.00 @	13.00
Philadelphia pressed	24.00 @	25.00
Trenton "	24.00 @	25.00
Baltimore "	37.00 @	41.00
Buff "	33.00 @	35.00
Enameled English	65.00 @	130.00
" American	85,00 @	120.00
Fire brick	25.00 @	40.00

CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

BAETJER & MEYERSTEIN:		
Hanover Portland	$2.60 @	$2.65
BELLONI & CO.:		
Hemmoor "Crown" brand		2.50
JAMES BRAND:		
K. B. & S	2.55 @	3.00
BROOKS, SHOOBRIDGE & CO.,	2.55 @	2.60
HOWARD FLEMING:		
Gibbs' English Portland, 400 lbs	2.65 @	2.90
K. B. & S. " "	2.75 @	2.95
Stettiner. German	2.65 @	2.85
Lagerdorfer, "	2.45 @	2.75
Fieve, A 1, Belgian	2.35 @	2.50
Roman	2.75 @	3.00
Keene's Coarse	4.75 @	5.50
" Fine	7.75 @	8.50
" Superfine	8.50 @	10.00
GABRIEL & SCHALL:		
Vorwohler "Lion"	2.65 @	3.10
HUDSON RIVER CEMENT CO. Rosendale		1.10
JOHNSON & WILSON:		
Saylor's American Portland	2.15 @	2.40
LAWRENCE CEMENT CO.:		
Hoffman Rosendale.		
LESLEY & TRINKLE:		
MARCIAL & CO.:		
J. B. White & Bros. Coarse	4.50 @	5.00
" Fine	8.00 @	10.00
" Portland	2.45 @	2.85
NEW YORK CEMENT CO.:		
Rosendale		1.20
N. Y. & ROSENDALE CEMENT CO.:		
Rosendale, "Bridge" brand		1.00
F. O. NOSTON brand		1.10
SINCLAIR & BABSON:		
Alsen's Portland	2.45 @	2.75
STANDARD CEMENT CO,		
E. THIELE:		
Dyckerhoff	2.90 @	3.25
UNITED STATES CEMENT CO.:		
Windsor	1.00 @	1.10
Standard		1.15
Cable's Portland	2.15 @	2.40
UNION AKRON CEMENT CO.:		
Akron "Star" brand.		

ASPHALT.

Prices range per ton	$15.00 @ 20.00
According to quantity or brand, and whether taken from vessel or store,	

LIME.

Rockland common per bbl	1.00
" finishing	1.20
State, common	.90
" finishing	1.10
Kingston, ground	0.95
Add 25c. to above figures for yard rates.	

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.90 @	95
" " No. 2 "	0.75 @	0.80
" " light drab "	0.80 @	0.95
Berlin " in rough "	0.75 @	1.00
Berea " " "	0.75 @	1.00
Brownstone, Portland, Ct. "	1.00 @	1.30
" Belleville, N. J. "	0.75 @	1.25
Granite, rough	0.60 @	1.25
Common building stone per load	2.00 @	3.00
Base stone, from 2¾ to 6 ft. lengths, per lin. ft.	0.40 @	3.00

SLATE.

Purple roofing per square	6.00 @	7.00
Green "	6.00 @	7.00
Red "	15.00	
Black Penna. (at New York) "	4.50 @	5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00 @	20.0
Choice "	55.00 @	80.
Tally plank, 1¼ in. 10 in. dres'd. each.	.44 @	.50
Tally boards, dressed com. "	.28 @	.30
SPRUCE, Boards dressed "	.25 @	.28
Plank, 1¼ in "	.28 @	.30
" 2 in. "	.38 @	.40
" 2 in. dressed "	.43 @	.45
Timber per M.	20.00 @	22.00
HEMLOCK, Boards each.	.18 @	.20
Joist, 2¾ × 4 to 4 × 6 in	.17 @	.44
OAK per M.	55.00 @	65.00
CYPRESS 1, 1¼, 2 and 2½ in "	35.00 @	40.00
YELLOW PINE, Girders "	25.00 @	30.00
Dressed flooring "	28.00 @	35.00
SHINGLES, Extra shaved pine, 16in. "		
" sawed 18 in. "	5.75 @	6.00
LATH, Cargo rate "	2.10 @	2.25

PAINT.

Lead, white, American dry per lb	.04¾ @ .05
" " in oil pure "	.05¾ @ .05¾
English, B. B. in oil	.08¾ @ .08¾
Red, American	.05¾ @ .05¾
Litharge "	.05 @ .05¾
Venetian red, American "	.01 @ .01¾
Indian red "	.05 @ .10
Vermillion, American lead "	.11 @ .11¾
Paris green "	.18 @ .19
Umber, Amer. raw and powdered per lb.	.01¾ @ .01¾
Drop black, Amer. "	.08 @ .12
" " "	.09 @ .11¾
Chrome green	.05 @ .15
Oxide zinc, American	.03¾ @ .04
" French	.06¾ @ .06¾